JUL 23 1917

Engineering News-Record

A Consolidation of Engineering News and Engineering Record
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In This Issue:
Constructing the Army's Big Aviation Camp at Detroit.
Wide Roadway of Cleveland Bridges Concreted Cheaply.
Monumental Portal Completed at the Approach to Manhattan Bridge.

This is one of the recently completed portals at the Manhattan Bridge approaches in New York City. At the bridge ends are large plazas, the development of which made it necessary in some places to make extensive changes in the locations of the streets.

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ENGINEERING NEWS-RECORD

A WEEKLY JOURNAL
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AND CONTRACTING

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Clearing Away Doubts Will Steady Construction

THE week's developments clear away some of the doubts that have tended to block construction. The conflict of opinion on shipbuilding appears to have been settled in the main, with the decision to go into steel ship production on a large scale. This means that most of our plate-rolling capacity will be needed for Government use, and along with it some structural-shape capacity—since special ship shapes, it is rumored, are to be very largely eliminated from the ship designs. At the same time a conference between Government authorities and the heads of the steel industry brought specific assurance that the Government will get all the steel it needs, a fact that really could admit of no doubt. At present, then, we know definitely that private use of steel will be curtailed considerably. The work of engineers will adjust itself accordingly, the more promptly now that doubts are cleared. The big problem remaining is the settlement of prices, on the one hand, and deliveries and priority, on the other. This problem still furnishes ample room for worry.

Narrow Rivers Make Poor Lake Terminals

SMALL rivers emptying into the Great Lakes made splendid shipping ports for the commerce of earlier days, but they do not serve modern shipping efficiently or even safely. Long-standing custom prevents their being abolished summarily. Otherwise they would long since have ceased to be used as ports. Now, millions of dollars are invested along the river wharves. Chicago and Cleveland have made a courageous beginning in developing lake-front terminals. New emphasis is laid on the necessity of modernization by an accident in the Milwaukee River harbor two weeks ago. The overhang of a steamer being towed out through the winding river collided with the supports of an elevated water tank standing close to the wharf line, and the tank falling upon the vessel crushed nearly a score of lives out of existence. The sad occurrence is a solemn and direct warning to Milwaukee that it must proceed at once toward developing a lake-front shipping terminal. Its river is no longer adequate to serve as a harbor and for many years past has been notoriously inadequate. Auxiliary circumstances of the accident, such as the peculiar construction of the steamer involved—the whaleback "Christopher Columbus," with its high and long overhang—and the position of the tank close up to the front of the bulkhead, although the laws prescribe several feet of clearance width, merely emphasize the force of the main teaching that the narrow, crooked rivers of the Great Lakes should be abandoned as ports for large vessels just as speedily as possible. Their usefulness as terminal basins is over.

Cast-Iron Pipe Again to the Front

A LIVELY discussion of cast-iron pipe specifications occupies six pages of this issue. It will appeal to those interested in cast-iron pipe, or in specifications for that and other materials, or in the psychology of committees composed of manufacturers and users of a given material which is to be standardized. The letters beginning on page 109 speak for the various parties in interest. Editorial tailnotes to the letters answer, so far as answer is necessary, various allegations by the pipe manufacturers based on apparent misunderstanding by them of the editorial comment in our issue of May 31, 1917. We did not go into the merits or demerits of the proposed changes in the specifications. We reported and attempted to interpret what happened at the Richmond convention. We deprecated the attempt to block revision and suppress the tentative draft. If we had little to say for the manufacturers' side it was because they said little for themselves at Richmond and because that little was aimed against publicity. Now that the manufacturers come forward with their side of the case we gladly give space to it—and to a rejoinder from the pipe-user or engineer members of the committee.

One Further Step of Progress Needed

IT WOULD be a pity if after six years' committee service, and after representatives of the committees of the American and New England Water-Works Associations had at last got together and blended two "standard" specifications for cast-iron pipe into one, the work should come to naught. This does not mean that the "tentative draft" must be adopted as it stands. The very label it bears presupposes discussion, modification—compromise, if need be. We are optimistic enough to hope that the two elements will get together on a basis of mutual concession; or if that prove impossible then that clear-cut majority and minority re-

ports will be presented, each embracing a single standard specification, common to both associations. If a compromise specification or majority and minority specifications cannot be framed between now and mid-September, the New England Water-Works Association may be forced to a decision on a "deadlock by courtesy" situation. What it will do is an interesting subject for speculation, but one which should not be left to speculation alone. Wise action is imperative.

Grade vs. Distance

THE practical application of railway economics is illustrated by an article elsewhere in this issue. In the case cited, the traffic capacity of a division is to be increased by reducing the ruling grade 50% at the expense of increasing the distance nearly 33% and greatly increasing the curvature. This will eliminate the former necessity of breaking up trains for operation over the heavy grade, and will thus make an important reduction in the number of trains required to handle the tonnage.

Besides reducing adverse grades, the improvement will give a double-track section. The new line will be used for the heavy eastbound traffic, while the old line will continue in use for the lighter westbound traffic (downgrade) and also for passenger traffic on account of the towns along this line. A similar case, on a larger scale, was the reduction of grade from 4.4% to 2.2% on the Canadian Pacific Ry. a few years ago. This was in such mountainous country that spiral tunnels had to be introduced to obtain the necessary development in distance.

Line-revision of this kind is the opposite of much improvement that has been done on light-grade lines in the way of reducing curvature (and distance) by straightening the original alignment. But for its purpose of cheap freight movement, it is just as clear an instance of basing improvements on true economic principles.

Build Roads!

COMMUNITY-CONNECTING road building must not stop. These roads are the basis of the additional transportation capacity required to meet commercial needs. In a few localities an anomalous condition has arisen in the transportation problem. Embargoes have been placed on the hauling of materials for roads which when constructed would relieve the very congestion complained of and provide the additional commercial carrying capacity so much desired. The clamorings of road politicians for construction, but in "my district," were never so completely answered, for through routes and direct connections between important business centers were never so much in demand. With the thousands of trucks ordered by the Government and still other thousands commandeered by commercial interests to augment rail deliveries, roads must be built quickly over which the equipment is to operate.

Akron, Ohio, tied up with a package-freight embargo, was able to break it by fleets of motor trucks reaching out in a radius of 20 miles to fourteen shipping points. Now, every evening motor trucks in large number and on schedule time start for Cleveland. A New York drug firm makes weekly deliveries in Boston and Philadelphia with trucks and trailers. Cleveland manufacturers have put on regular motor-truck service to bring in castings from foundries 20 and 30 miles away. A steam-shovel company in Lorain gets material by truck from Cleveland and has made deliveries to Elyria and Oberlin when freight service was unobtainable. A rubber-goods company with factories in Ohio and Connecticut is trying out a truck-and-trailer service between these two states, having found the delivery of tires from Akron to Detroit by the same means feasible. A rubber-heel company in Elyria states that it is obliged to use trucks for getting raw material from Akron and in getting the heels away from the factory—in this case putting the shipment on such a railroad that the goods will not require transfer. The moving of household goods between Chicago and Milwaukee by truck is an established business, and a 1200-mile driveaway delivery of nine trucks from Hartford, Wis., to Baltimore, Md., is not considered novel. An Elyria canning company is hauling 5- and 6-ton loads to Cleveland jobbers on regular schedule, giving much better and quicker service than the railroads, although it is somewhat more costly.

The Iowa Council of National Defense has called on the State Highway Commission to quicken rather than slacken road-building energies. Nothing, it holds, should be permitted to retard the good-roads work unless it should be inability to secure the necessary workers. Iowa needs nothing else so much as good roads.

In Connecticut the railroads have had an embargo on certain classes of freight for many months at a time. Motor-truck deliveries have made possible business which would otherwise have been at a standstill. State Highway Commissioner Bennett states that motor-truck transportation business has developed tremendously in the last year. He is building sheet-asphalt pavements on a 6-in. concrete base on country roads.

This is no time for state officials to halt road-building activities, particularly on intercity connections. The transportation congestion, which the three Middle-West state governors have recently attempted to alleviate by their proclamations halting road construction, needs strong curative measures, and road construction is one of the largest factors in the solution of the problem. The legislators of Illinois have faith in the idea, for they have recently passed a $60,000,000 bond issue for a 4400-mile comprehensive system.

Costs are high, but when will they be lower? Let the engineer raise his estimates if necessary, the material men be moderate in their price advances lest they kill the business entirely, and the contractor develop more efficient methods and utilize machines to replace men to the limit. To the man with vision the need is far greater than the price. In war time it is the accomplishment itself that counts.

Call in the Men Who Know

MUCH has been said and little of a tangible nature has so far been accomplished by official Washington in the way of effectively fixing the prices of important materials. It is said that Cabinet secretaries have forced low prices by threatening to commandeer plants. The President himself has issued a lengthy proclamation to the manufacturers of the country exhorting them to refrain from "putting up the price." While it is now the apparent intention to settle the entire matter out of hand on the basis of the findings of the Federal Trade Commission, the public, especially that part of it interested in engineering construction, is still forced to cool its heels in a state of uncertainty.

Should the Government seize a controlling quantity of any material, such as steel, at a price far below the market, other consumers would have to make up the difference in higher prices forced by an excessive demand. Should it attempt, by legislation, or even possibly by agreement, to fix a maximum price for the entire market, the whole movement might be found unconstitutional and void. Should the Government take it out in talk and pay substantially the normal market price, all conditions point to a continued gradual rise.

However, the effect of the recent backing and filling has been most harmful. The public must know at once where it stands. If we are to be unconstitutionally taxed in order that the budget of some Federal department may make an excellent showing, let us be informed of it and make our plans accordingly. If maximum prices to everyone are to be fixed at such a level as to throw out of business part of the capacity of some important industries because that part can produce only at high prices, we should know that also, in order that our consumption might be curtailed before it is too late. Should the entire agitation be destined to end in a fizzle, we should know that immediately in order that plans for necessary work may go ahead without further needless interruption.

The administration must recognize that the economic side of this subject is much more important than the political. President Wilson's proclamation hardly scratches the subject. In times like the present when money is plentiful (there is now in circulation in this country $45.50 per capita in currency as compared with $35 in 1914), when business is active, general demand extraordinarily large, and when to these conditions is added a Government demand for $7,000,000,000 of material a year, it is useless to expect to hold down prices by appealing to the patriotism of producers. Producers have little to do with the matter. If the entire consuming public of every commodity on the market in this country could be reached, could be convinced, and could be induced actually to curtail its consumption, demand might be brought within the compass of possible production and one economic cause for price increases thus removed. To state this proposition is to indicate its impossibility, and perhaps it was this realization that led the President to appeal to the manufacturers.

Another error made by those in authority in this connection consists of attempting to tell the public that the present price increases are actually measured by the indicated increase in terms of currency. The total gold stock of this country exceeds by more than a billion and a quarter dollars the stock at the outbreak of the war. Currency inflation from this source alone is sufficient to send the apparent price of materials soaring. Of course, this condition might be remedied to a great extent by getting hold of most of this stock of gold and putting it under lock and key in the vaults of the Treasury Department. However, the Federal Reserve Board has been attempting to do just this thing for eighteen months, and judging from the continued rise in prices, it has not met with vast success.

Another economic consideration which some Washington proponents of price fixing are prone to disregard is the fact that the earnings of a given business are not constant in volume over a long period of years. Profits diminish to the vanishing point in many industries during a period of depression and are brought up to a fair average level by a higher margin when demand is good. Should any action taken now result in shearing some of the industries of the country of the extra margin of income which should serve to establish the surplus they will sorely need during the depression that is bound to follow, incalculable harm might be done to industry.

Of course, on the other hand, no one has any sympathy with a group of men who are determined to squeeze the last possible penny of profit out of a situation which might put the country at their mercy. However, while such undoubtedly exist, it is believed that they constitute a small minority.

The sharp complaint of a consumer, printed on another page, intimates how feelings have been roused by the price-history of recent months. But at the same time it utters a warning also against Governmental inactivity. The Administration's attitude, perhaps, as presented on page 106, gives encouraging hopes.

Everything points to the wisdom of calling on the expert advice of business itself, rather than depending exclusively on the findings of any Government agency. Only the men who have been producing steel, copper and other commodities for years know the course of these industries over so much as one full credit cycle, and can predict the probable effect after the war of any prices that may be agreed upon now. Even the biggest of these men cannot marshal all of the facts and figures necessary to form such conclusions without calling in subordinates and producing masses of records. It is useless to expect that Government accountants, after a necessarily brief investigation, could reach a safe conclusion on such matters. The attitude on the part of certain Congressmen and Cabinet officers that all business men are thieves and that their statements and opinions must be considered as distorted in the light of their own selfish interests will have to be abandoned. The men who really know must be called in and given a fair opportunity. Get together!

Improved Major-Street Plan for St. Louis Proposed by City Plan Commission

Lack of Planning Has Resulted in Disjointed Narrow Main-Traffic Streets, with Weak Radial System—Widening and Minor Extensions Proposed—Argument Reinforced by Striking Maps

BY HAROLD BARTHOLOMEW
Engineer, City Plan Commission, St. Louis, Mo.

IN APRIL, 1916, the City Plan Commission of St. Louis adopted a program for preparing a comprehensive city plan that included special studies of streets, transit, transportation, districting, recreation, housing and grouping of public buildings. It was estimated that to complete each of the special studies and then to correlate them into a comprehensive plan would require about three years. The study of streets has been completed, and substantial progress has been made with several of the other projects.

The "major-street plan" furnishes many interesting points respecting improper or inadequate street layout. The plan also reveals most clearly the relation of the street to all the other components of a city plan and demonstrates the necessity of a carefully prepared and closely followed comprehensive plan in any rational form of city maintenance or city growth.

The failure to recognize and differentiate the various classes of streets in most cities is almost incredible. In St. Louis, for instance, it is estimated that 75% of the streets are 60 ft. wide, an insufficient width for a heavy traffic street and of too great width for less intensive residential purposes when a considerable setback line is used so extensively as in St. Louis. Fig. 1 shows the very promiscuous platting of streets over 60 ft. wide in St. Louis, which indicates not only haphazard development, but poor traffic facilities and much economic waste. Fig. 2 shows a proposed major-street plan designed to lessen existing deficiencies.

In Kansas City, a city of unusual topography, virtually all the streets are perfectly straight with scarcely the semblance of even a radial thoroughfare anywhere. Numerous other cities offer conditions equally absurd and unwarranted.

In general, the streets of St. Louis quite naturally divide themselves into three groups, as follows: Radial thoroughfares; crosstown thoroughfares; minor residential or industrial streets. No hard and fast rule for standardizing streets can be adopted, but for purposes of establishing some fixed plan, the above classification has served to good purpose in St. Louis. It might or might not apply elsewhere.

The use of 60-ft. streets in St. Louis has made it extremely difficult to provide adequate capacity for all the normal demands of traffic. Yet, under certain conditions, the 60-ft. street has proved itself capable of carrying a tremendous volume of traffic. Locust St., the heaviest traffic street in St. Louis, is but 60 ft. wide,

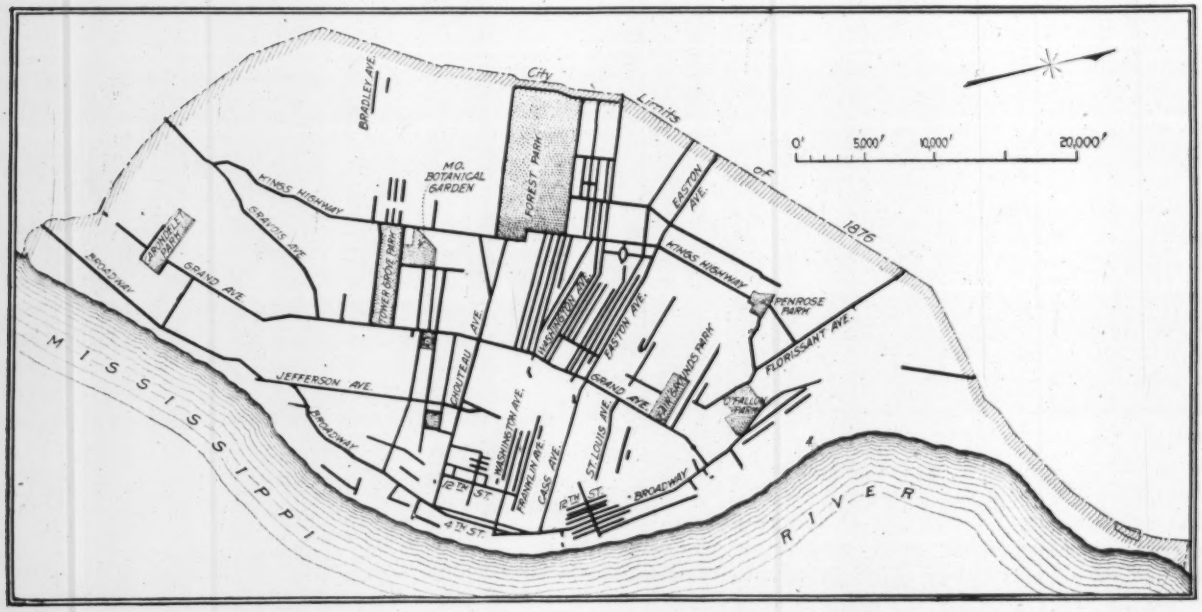


FIG. 1. THE PRESENT MAJOR STREET PLAN OF ST. LOUIS, AS DEVELOPED BY INDIVIDUAL LAND SUBDIVIDERS, ILLUSTRATES COMPLETE ABSENCE OF PLANNING, WITH CONSEQUENT WHOLLY INADEQUATE FACILITIES FOR TRAFFIC MOVEMENT

The streets shown are all those in the city having widths of more than 60 ft. They represent 15 per cent. of the total street length of St. Louis

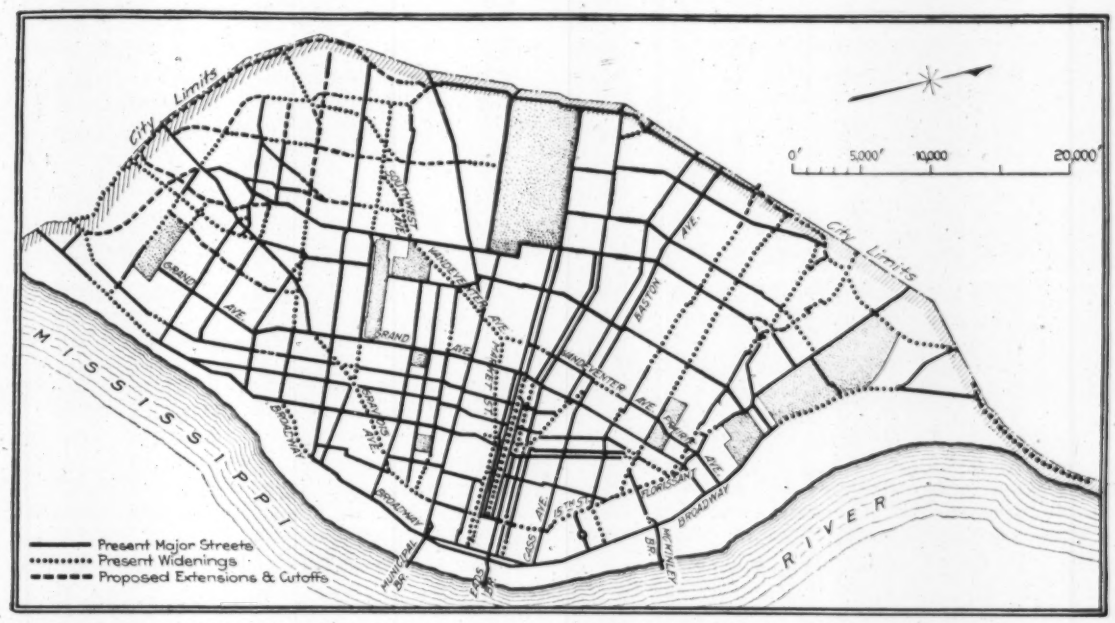


FIG. 2. MOST OF THE NECESSARY CHANGES TO PROVIDE THE PROPOSED MAJOR STREET PLAN ARE FOR WIDENING EXISTING STREETS

The changes would be largely in the outlying districts where their accomplishment would not be difficult

yet it carries over 1400 vehicles per hour during the evening rush hours. Until recently there was a 36-ft. roadway with two sidewalks of 12 ft. each. In March of this year, the roadway width was increased to 42 ft. by setting back the curb 3 ft. on either side. This permits three lines of moving vehicles in the direction of greatest traffic movement. The sidewalks, of 9 ft. each, would now be inadequate if there was any amount of pedestrian traffic, which there is not. There are no trolley tracks.

Few streets will ever have so great a volume of traffic. This is an evidence that heavy traffic streets need not always be exceptionally wide. In fact, several streets of small width in a zone of heavy traffic movement are more to be desired than one street of excessive width, since to diffuse traffic facilitates handling and, what is still more important, helps to diffuse property values.

Where trolley cars must also be provided for, as is most often necessary on major traffic streets, increased width is necessary. The following standards for widths of major streets were adopted (see also Fig. 3):

GENERAL STANDARDS FOR WIDTH OF MAJOR STREETS

Without trolleys:
60 ft. minimum; 2 sidewalks, 28 ft.; 4 vehicles, 32 ft.
80 ft. where possible; 2 sidewalks, 32 ft.; 6 vehicles, 48 ft.
With trolleys:
80 ft. minimum; 2 sidewalks, 28 ft.; 4 vehicles, 32 ft.; 2 trolleys, 20 ft.
98 ft. where possible; 2 sidewalks, 30 ft.; 6 vehicles, 48 ft.; 2 trolleys, 20 ft.

Where it was found inadvisable to recommend the widening of a major street that would be unable to meet the demands of traffic, the alternative of providing two such streets was adopted, one for trolley cars and heavy slow-moving vehicles and one for fast vehicles only.

To determine the character and extent of traffic movement on the streets of St. Louis, a detailed traffic census was made in April and May, 1916, each period of observation covering 11 continuous hours, from 8 a.m. to 7 p.m. Counts were made on typical weekdays, not including Saturdays or Sundays.

This census disclosed numerous interesting and valuable facts, which can be summarized in part as follows: Horse-drawn traffic is not concentrated on particular streets or in particular sections; automobile traffic is greatly concentrated on certain routes offering least obstruction to through travel and having smooth surface pavements; there is need for more uniform distribution of eastbound and westbound traffic; and there is need for better approaches to the business district from north and south.

Of 323,869 vehicles counted at 245 points on 84 different streets, the number and character of vehicles and their percentage of the whole were as follows:

	Number	%
Horse-drawn	102,168	31 5
Passenger automobiles	169,365	52 4
Motor trucks	52,336	16 1
Total	323,869	100 0

The total flow of daily traffic is shown graphically by Fig. 4. This includes all automobiles, horse-drawn

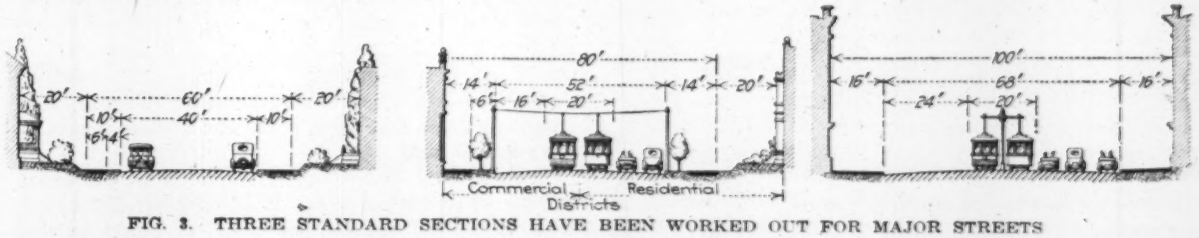


FIG. 3. THREE STANDARD SECTIONS HAVE BEEN WORKED OUT FOR MAJOR STREETS

vehicles and trolley cars. An interesting result of the traffic census is shown by comparing the movement of automobile traffic with the movement of horse-drawn traffic, shown graphically by Figs. 5 and 6. It will be seen that the great volume of automobile traffic is con-

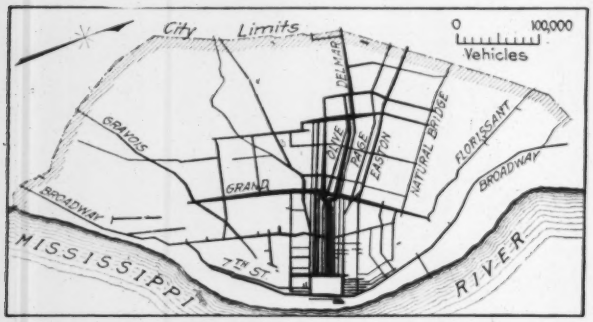


FIG. 4. THE RELATIVE VOLUMES OF TOTAL TRAFFIC ON ST. LOUIS STREETS ARE INDICATED BY THE WIDTHS OF LINES

Note: (1) Lack of continuous routes north and south and (2) the large proportion of travel to and from the west. Horse-drawn vehicles, automobiles and trolley cars are included. Count made at 232 observation points, from 8 a.m. to 7 p.m., July 3, 1916

fined almost exclusively to a few streets. The horse-drawn traffic is quite diffused, showing lack of concentration at any point.

The natural conclusion from this comparison is that the change in traffic conditions in large cities is even more pronounced than is generally realized. Horse-drawn traffic is largely oblivious of routes, of grades and of pavements. Automobile traffic, on the contrary, seeks a through route and a smooth pavement where there is little resistance to quick movement. The automobile, in fact, will travel considerably out of its way to secure these advantages.

The business district is the principal objective of all traffic. Since this district is in the extreme eastern central part of the city, there are three means of approach—from the north, the west and the south. The following table shows the character and percentage of all traffic entering and leaving the business district according to its direction:

TRAFFIC ENTERING AND LEAVING BUSINESS DISTRICT

	Vehicles		Street Cars	
	Number	%	Number	%
South	7,421	19	1,676	18
West	19,578	51	4,260	47
North	11,335	30	3,105	35
Total	38,334	100	9,041	100

The similarity in percentage of vehicular and street-car traffic entering and leaving the business district from the various directions is indicative of the fact that both classes of traffic find accommodation in the same directions and in a general way use the same thoroughfares. Some of the traffic entering and leaving the business district from the west eventually goes either north or south, as shown by Fig. 4.

The distribution of population by districts in St. Louis is approximately as follows:

ESTIMATED DISTRIBUTION OF POPULATION (1910 CENSUS)

	Population	%
North (north of Easton and Cass Aves.)	210,007	30
West and central (between Mill Creek Valley and Easton and Cass Aves.)	217,533	32
South (south of Mill Creek Valley)	259,689	38
Total	687,029	100

Comparing this with the percentage of traffic entering and leaving the business district from the same general direction, it is quite evident that traffic facilities are not at all proportional to the distribution of population—a further justification for principal street connections to these districts.

PERCENTAGES BY DISTRICTS OF POPULATION AND TRAFFIC

	Traffic Entering Business District	% of Total Population
North	30	30
West	51	32
South	19	38
Total	100	100

RADIAL THOROUGHFARES

Practically no new radial thoroughfares have been considered necessary. All changes recommended (Fig. 7) in the present very nearly complete system of radial thoroughfares were for increased width and some few extensions. In but one or two instances was a width of less than 80 ft. considered sufficient for a radial thoroughfare.

The presence of the Union Station, the large freight depots and the levee steamboat landings, all in close proximity to the business district, emphasizes the importance of completing the system of radial thoroughfares.

RECTANGULAR THOROUGHFARES

Since the rectangular street plan has been used so widely in St. Louis, the matter of providing an adequate number of crosstown thoroughfares is not difficult. The greatest changes necessary will be for increased width in many places, the removal of many irregularities, and some extensions or an occasional new

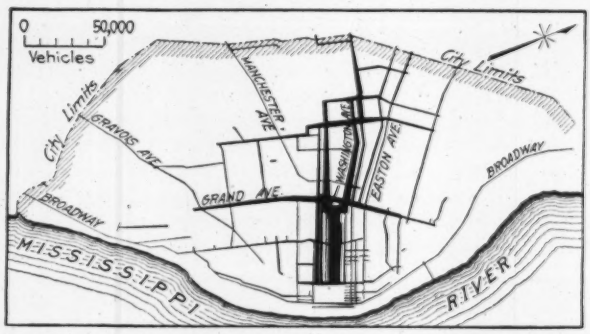


FIG. 5. THE TOTAL DAILY FLOW OF AUTOMOBILE TRAFFIC CONCENTRATES ON A FEW THOROUGHFARES

Count made at 238 observation points, June 19, 1916, from 8 a.m. to 7 p.m.

street. A principal deficiency that usually results from following too closely the rectangular street plan is irregularity, or the offsets which break the continuity of a street at its intersection with intervening streets.

At the busiest part of Grand Ave., the heaviest north and south traffic street, there is but one direct crossing for four most important streets. Fig. 8 shows the manner in which it is proposed to overcome the irregularities. Each will cost many thousand dollars. Direct crossings could have been made at no additional cost in the original plan.

The business district of St. Louis is at the extreme eastern edge of the city. It is considerably removed from the actual physical center of St. Louis, as shown

by Fig. 7. During the past 40 or 50 years the business district has shifted several times. Its center was originally on Market St. east of Broadway, later on Broadway near Franklin Ave., then near Broadway and Olive, while today Washington Ave. is the most active street in the business district.

The great growth of the city westward has induced a westward movement of the business district. While

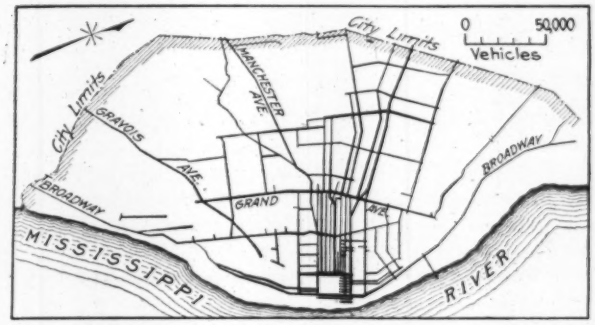


FIG. 6. HORSE-DRAWN VEHICLES AND MOTOR TRUCKS, IN TERMS OF TOTAL DAILY FLOW, SHOW LITTLE CONCENTRATION ON ANY STREET

Count made at 238 observation points, July 25, 1916

the movement has not yet become pronounced, a considerable subsidiary small business center, or more particularly small business and large amusement center, has developed at Grand Ave. and Olive St., fully two miles to the west. This latter point is more nearly the actual physical center of St. Louis. It is not considered probable that the actual business center will ever remove far westward, however, since the development in later years of several towns east of the Mississippi River now makes the present business district of St. Louis the physical center of the metropolitan district.

In order to help stabilize the business district and yet provide room for expansion, the major-street plan anticipates the development of four thoroughfares as boundaries to the business district—4th St., Market St., 12th St. and Washington Ave. The quadrangle thus formed has an area of approximately 0.2 square mile. It does not inflexibly fix the boundaries of the business

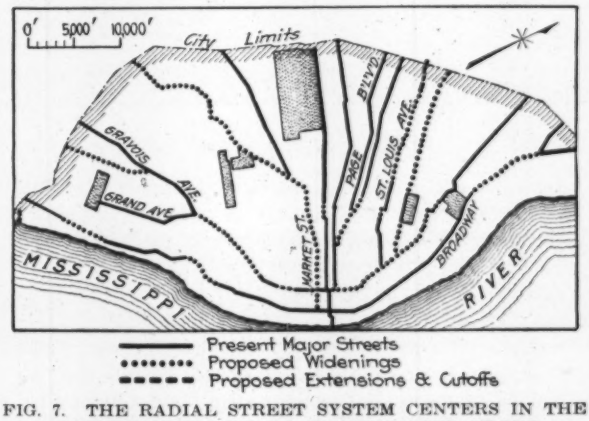


FIG. 7. THE RADIAL STREET SYSTEM CENTERS IN THE BUSINESS DISTRICT NEAR THE WATER FRONT

Proposed street widenings are shown. The Mississippi River makes a considerable bow at St. Louis. Consequently the business district, which has always remained near the original site of the town, is considerably removed from the physical center; but it is at the physical center of the metropolitan district

district, but will encourage a more uniform development with opportunities for eventual expansion to the north and west. Under the bounding streets will probably come a future rapid-transit loop.

Of interest in the preparation of the major-street plan is the fact that no provision has been made for the operation of interurban lines on the street surface. It is the aim to separate the interurban lines entirely from the transit system and, so far as possible, keep them on private rights-of-way.

Importance of a Major-Street Plan

The obvious advantages of a major-street plan are:

1. It simplifies future work. Whenever an extensive street extension or widening becomes necessary, it can be made in accordance with a well-defined generally accepted plan.

2. It will be a means of great economy in the transit and transportation problems. As improvements in the major-street plan are made, certain rerouting of the transit lines can be made, which will reduce the time and the cost of operation. St. Louis is the largest city in the country having surface transit only. It is not yet in a position to construct rapid-transit lines. By carefully executing the major-street plan, good service can be provided without the necessity of heavy expenditures for rapid-transit lines within the next few years. When rapid-transit lines are needed, it will be possible

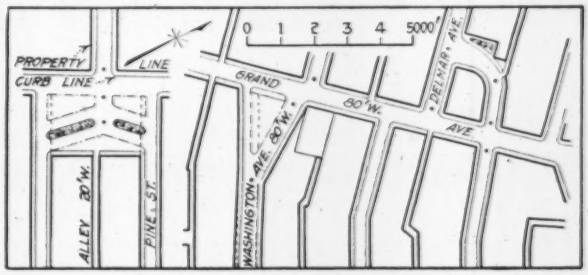


FIG. 8. CONSIDERABLE TRAFFIC CONGESTION WOULD BE ELIMINATED BY PROPOSED CUTOFFS AT GRAND AVE.

The streets beyond Grand Ave. were laid out privately without regard to the street plan of the city

to construct them to better advantage and greatly reduce the cost.

3. It encourages much more economic city maintenance. The major streets will gradually develop as the principal channels of travel. They will consequently reduce the miscellaneous movement of traffic on minor streets. On these minor streets, then, considerable expense can be avoided by reducing the width of the roadway and by laying, in many instances, pavements of considerably less cost. On 17.4 miles of streets to be improved in 1917, the standards for major-traffic streets will be adopted, while the roadways of minor streets, where possible, are being reduced from 36 to 26 ft. in width and less expensive paving laid. The remaining width of 10 ft. is being devoted to grass or shrubs.

To discourage traffic on minor streets means greater privacy and hence greater stability of values and development. While this is the object of all districting restrictions, it is believed that the logical development of the streets as herewith suggested will materially help to accomplish the desired results. Districting restrictions can then be invoked to assure the desired results.

Four miles of city streets are annually cleared of poles and wires by ordinance. A program for 20 miles of streets to be cleared in the next five years is being prepared. All the streets cleared will be major-traffic streets. It is also hoped that a standard system of lighting can gradually be installed on all the major streets.

Serious attention has been given to the methods and means of executing the major-street plan in the easiest and most economical manner. A uniform method for arriving at the amount of cost to be paid by the city and by assessment, quite similar to that adopted in New York, has been suggested. The city's share will be increased in proportion to the increase of street width. A more logical manner of determining the benefit district has also been recommended, the principle followed being that, in general, all property on or adjacent to thoroughfares which have been given more direct connections to various other parts of the city shall be included in the benefit district. By so doing, the benefit district is enlarged and the assessments are more equitably distributed in accordance with the benefit derived.

As to methods of payment, the most important recommendation is that for large improvements the city be permitted to issue special bonds for completing the entire project at once. These bonds would not be included in the regular debt limit, but should be special bonds, the collateral for which would be the tax bills issued for the improvement. Benefit assessments could be paid if desirable, in installments covering a period of from 10 to 20 years, the first payment to be deferred for 5 years in order that an owner may actually begin to derive benefit from the improvement by the time the payment falls due.

At the next session of the legislature the passage of the following laws will be sought to secure the necessary authority for completing the major-street plan: (1) Establishment of building lines; (2) the creation of permanent assessment boards; (3) approval of all land subdivisions; (4) constitutional amendment granting power of excess condemnation; (5) constitutional amendment permitting the establishment of streets on the city plan; (6) a law authorizing the creation of county plan commissions; (7) a law authorizing the creation of city plan commissions in small cities.

Locomotive Cranes Erect Cantilever Bridge Over Ohio River

Suspended Span Swung on May 10 Practically Completed Construction by Method Applied for First Time to Big Cantilever Span—Single-Track Structure Is 1120 Feet Long

By J. L. DE VOU
Division Erecting Manager, American Bridge Co., Pittsburgh, Penn.

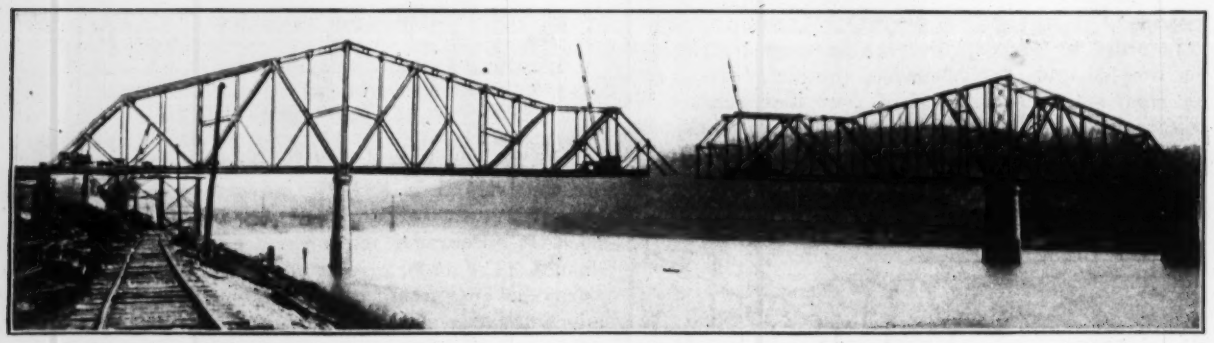


FIG. 1. ERECTION OF CANTILEVER BRIDGE BY LOCOMOTIVE CRANES APPROACHING CLOSURE

A FORWARD step in the development of bridge-erecting methods was recorded when on May 10 the suspended span of the new cantilever bridge across the Ohio River at Steubenville, Ohio, was swung. This single-track steel bridge 1120 ft. long and 110 ft. deep over the main piers was erected complete by two locomotive cranes operating on a central track placed as the erection progressed. Another special feature of the construction which marks a departure from common methods is seen in the use of hydraulic jacks instead of wedges and screws for the final adjustment in swinging the suspended span for closure. The erection features were carefully considered by designer and detailers and included special pins for eye-bar top chords and spacing of the trusses 30 ft. apart in order to allow complete reversal of the erecting cranes and the necessary space for a temporary material track.

This structure is being built for the Ohio-West Virginia Bridge Co., a subsidiary of the Labelle Iron Works, of Steubenville, and connects the new byproducts coke plant on the West Virginia side of the river with the furnaces and mills on the Ohio side. It is a single-track railroad bridge with a plate-girder approach at each end. The cantilever bridge has a total length of 1120 ft., made up of two anchor arms of 230 ft. each, two cantilever arms of 180 ft. each and a sus-

pended span of 300 ft. The distance center to center of tower piers is 660 ft. The weight of the steel, exclusive of approaches, is 4088 tons.

The bridge is interesting principally because the American Bridge Co., contractor for the superstructure, used locomotive cranes exclusively in its erection, and it is believed to be the first cantilever bridge erected entirely with this kind of equipment. Two standard erecting cranes, equipped with booms 110 ft. in length, were operated from each end of the bridge.

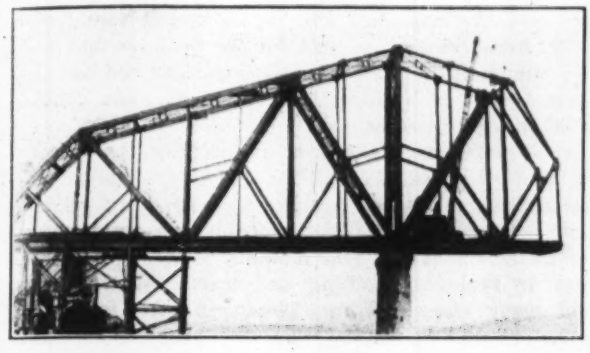


FIG. 2. EYE-BARS M_{11} L_{12} FOLDED BACK IN FIRST POSITION

The maximum depth of truss is 110 ft. center to center of chords. The width of the bridge is 30 ft. center to center of trusses. This width was enough to permit the use of a temporary material track beside the track that carried the crane laid in the center of the bridge. The material track was supported on stringers that will carry a footwalk in the completed structure. This width was also sufficient to let the cranes turn completely around for the purpose of erecting the top laterals and sway bracing behind them.

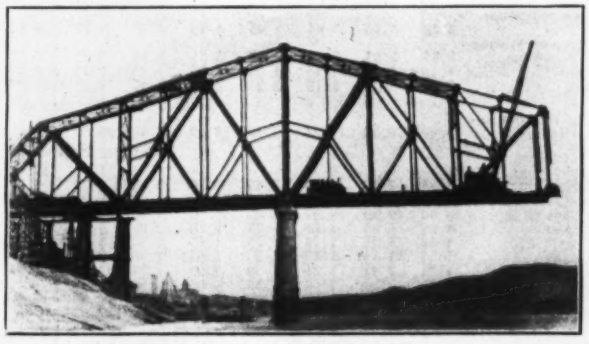


FIG. 3. EYE-BARS U_{14} U_{15} IN FIRST ERECTION POSITION

The design was made with the proposed method of erection in view, and the weights of all members were kept within the capacity of the cranes. While the erection could have been accomplished more rapidly and at less cost if the top chord of the cantilever arm had been a built-up, riveted member, the difference in weight and in shop costs threw the balance in favor of eye-bars. But since erecting with a single boom demands that each member shall be capable of being supported in place at once, so that the crane may cut loose from it and be free to handle the next piece, the designer was careful not only to keep to a minimum the number of members connected by any one pin, but also to make the arrangement of the pin joints such that the members could be set in place and supported before the pin was driven. For this purpose small lug angles were provided where necessary to hold the eye-bars in place.

At some points where two sets of bars come together, it was necessary to drive the pin after the first set of bars was placed, in order to enable the cantilever to carry the crane in the new position it must take before placing the second set. This condition occurred at *U*10, *U*12, *M*11 and *U*14. At *M*11 the two sets of bars were erected with the *M*11 *L*12 bars folded back almost parallel with the *U*10 *M*11 bars, and the pin was driven. After the trusses were sufficiently articulated (see Fig 2) to permit the crane to move forward to the required position for setting the heavy bottom chord *L*10 *L*12, the *M*11 L12 bars were rotated about the pin into their proper position.

A similar method was used at *U*12 and *U*14. In Fig. 3 the *U*14 *U*15 bars may be seen folded back above the *U*13 *U*14 bars. Because of the great height of truss at *U*10 the boom was not long enough to rotate the bars, so at this point separate pins were provided for each set of bars.

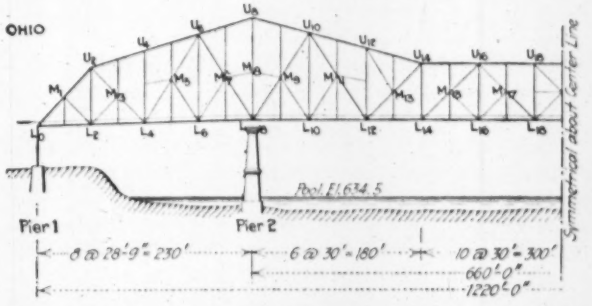


FIG. 4. HALF-ELEVATION OF STEUBENVILLE BRIDGE

Hydraulic Jacks Used for Closure

The use of hydraulic jacks instead of wedges and screws for the final adjustment incidental to swinging the suspended span is also believed to be new, and proved to be quite satisfactory.

The anchor arms were erected on wooden falsework; and owing to the urgent necessity for completion of the bridge as early as possible the erectors were obliged, though at grave risk, to go into the river with their falsework at the worst season of the year. The falsework fortunately withstood three floods, two of which were accompanied by running ice. The erection of the cantilever arm began in the week ended Mar. 3 on the West Virginia end and in the week ended Mar. 24 on the Ohio end. The suspended span was erected as a cantilever from each end in the usual way until swung on May 10.

The bridge was designed, fabricated and erected under the direction of Albert Lucius, consulting engineer. For the American Bridge Co., Richard Khuen is general manager of erection, and James L. deVou is division manager.

High Prices and Excessive Profits in the Consumer's View

In a strong newspaper article, the skyrocket price situation is sketched graphically by Zenas W. Carter, Commissioner of Associated Metal Lath Manufacturers, Cleveland, Ohio. Extracts below are quoted from "The Annalist."

The problem at issue is determining priority. The question of apportionment or rationing is just as vital in steel as in bread. Price-fixing entails rationing. Shall it be done by the government? Mr. Carter proposes "a mammoth mass convention of business men" to discuss prices and, presumably, settle apportionments.

The statements by President Wilson on July 12 should help to check the growing unrest among manufacturers over price conditions of raw materials. It has looked to the manufacturer and to the public so much like a "grab-while-you-can-and-what-you-can" price movement that resentment was growing into open protest. Note the accompanying table showing prices and fluctuations on iron, coal, coke and steel products during the four years of this war!

Manufacturers, business men generally and the public are becoming used to price increases, but an over-night doubling and trebling of prices already high was simply astounding. Topping that with reports of huge earnings in raw-material divisions of trade—unreasonable percentages of profit for steel mills, coal and iron producers and water carriers—was it not high time that President Wilson took a hand to stabilize business?

If warfatted business is permitted to use its position to gouge out profits from the public through competitive upward bids for material they control, the eventual result, almost in hazy distant view now, could not possibly be less than social revolution of the baser sort, even though it was morally justifiable.

It is not reasonable to presume that vehicle and implement and hardware and structural material and all commercial manufacturing utilizing steel, for instance, can pay from two to four times normal value for materials, then fabricate them, and sell the product to consumers at any price which it is possible for the consumer to pay, so long as the wages of that consumer have only been increased from 15 to 25% at best.

And, why should it be reasonable to suppose that the steel or coal industries, for instance, should have the millions of profits they show by their own records and monthly statements that they are making, and other lines of business be hanging on by their fingernails trying to keep their organizations partially intact, when, by the table of prices, anyone may read the fact that it is *our* (our, mind you, all of America) war which has caused our government (us, as a group of individuals) to require so much of their material that they are in a position to demand enormous profits from the public (us) on the balance.

Because of this just demand for price protection for manufacturing industry and the public, the President has outlined a program of *one price to all*, which is protective only and not in any degree confiscatory.

To put the plan of the President into practical operation and at once allay the present fearsome unrest of manufacturing organizations, due to the unreasonable and the unrestrained jumps in the prices of so many items of raw materials and necessities, it would certainly be an auspicious time for the business men and the manufacturers and their organizations and associations to call a National Convention at some central point in the United States.

It is quite possible a large majority of the citizens of the United States could live, and comfortably, without making many new purchases of anything whatsoever but food and fuel for probably one entire year; but at the end of that year it would be absolutely necessary to replenish clothing and household necessities and many other things. These must be fabricated therefore, and during the year—this year—so they will be ready for use next year. Can our manufacturing plants then be closed? Assuredly not! Price and material adjustments will have to be made.

This is a tremendously big country. It has resources almost unlimited. It has millions of people who must continue to live in the United States. They will have needs as well as our army abroad. It is therefore wisdom to give heed to this fact even amid our preparations for war. To give heed to it will increase confidence. Increased confidence will make us strong. Strength will win our war for us.

Let this be the keying stone on which a mammoth mass convention of business men shall meet. Courage to face fair prices, courage to meet changed market and manufacturing conditions, courage to face disrupted forces, courage to handle every problem we have to solve in this war, will come if men meet and tell openly what they are willing to do—what they can do—and what they are and have been doing. Their presence at a mass convention will strengthen their confidence in themselves as well as in their fellowmen.

Without such a group discussion of prices and conditions will it be possible for the investigators for the Federal Trade Commission to evenly distribute or even begin to give even a small portion of the relief that industry must have before Jan. 1, 1918?

PRICES AND FLUCTUATIONS ON STEEL AND IRON

	1914		1915		1916		1917	
	1/1	7/1	1/1	7/1	1/1	7/1	1/1	7/1
Old Range Bess..	3.75	3.75	3.75	3.75	4.45	4.45	5.95	5.95
Old Range Non-Bess.....	3.00	3.00	3.00	3.00	3.70	3.70	5.20	5.20
Iron ore Mesabi Bess.....	3.50	3.50	3.45	3.45	4.20	4.20	5.70	5.70
Iron ore Mesabi Non-Bess.....	2.85	2.85	2.80	2.80	3.55	3.55	5.05	5.05
Coal.....	1.15	1.15	1.15	1.05	1.05	1.23	1.23	4.00
Coke.....	2.48	2.30	2.10	2.25	3.90	3.30	9.50	13.00
							Basic Valley Furnace	
Pig iron composition.....	13.492	13.52	13.07	13.125	18.69	18.585	30.50	50.00
							Bessemer Pittsburgh	
							35.95	55.95
Ignot iron.....	2.55	2.50	2.50	2.45	3.30	3.60	5.20	8.70
Slabs.....	20.00	20.00	20.00	22.00	35.00	42.00	60.00	105.00
Billets O. H....	20.00	19.50	19.00	22.40	35.50	44.50	60.00	100.00
Sheets.....	1.85	1.80	1.80	1.75	2.60	2.90	4.50	8.00
Bars.....	1.20	1.15	1.10	1.25	1.85	2.50	3.00	4.50
Bands.....	1.20	1.15	1.10	1.25	1.85	2.50	3.25	5.25
Hoops.....	1.25	1.25	1.25	1.30	2.05	2.75	3.25	5.25
Flat wire.....	3.05	2.50	2.50	2.50	4.00	6.50	7.00	9.00
Wire rods.....	25.50	24.50	25.00	25.00	40.00	50.00	70.00	95.00
Wire.....	1.35	1.30	1.30	1.35	1.95	2.45	2.95	3.95

Iron ore, f.o.b. Lake Erie Dock; Coke, f.o.b. Furnace; Pig iron, f.o.b. Valley; Ingot iron, f.o.b. Youngstown; Balance, f.o.b. Pittsburgh; Coal, f.o.b. Mines—our contract prices.

Above are current prices, almost entirely as published in issue of "The Iron Age" nearest the dates given.

A Washington Inquiry:

Problems in National Price-Fixing

Officials Admit Dissatisfaction at Attempted Haphazard Price Dictation—Interferences in Purchasing May Lead to Government Purchasing Agency—Priority Difficulties—Study Costs

DEVELOPMENTS in Washington the past week forecast that the administration is definitely committing itself to a policy of fixing prices which shall be the same for the Government and for private industry, in connection with purchases made for both, on account of the country's stupendous war activities. A special investigation made by a correspondent of *Engineering News-Record* in Washington brings to light various interesting conditions.

The price-fixing movement has been much debated in Congress in connection with the committees of the Council of National Defense. Also, important statements concerning it have been made public during the past week, by President Wilson and by Secretary Lane of the Interior Department. There has been much dissatisfaction at the manner in which prices for some materials have been fixed for the Government, at the same time leaving up in the air the question of the prices to be paid by private industry for the same materials.

Some of the highest officials in Washington, who consented to analyze the situation for *Engineering News-Record*, point out that there has never in the history of the country been such a demand as at present for basic raw materials, that the Government takes large amounts of the available supplies, and that men in private industry who must have these materials are obliged to go into the markets and get them no matter what prices they may be obliged to pay. Their statements also showed that the reports of great complications and interferences in the general purchases which are being reported in private industry are true.

New Purchase Agencies Are To Be Created

The result will be, from the best information obtainable, that there will be a reorganization of the Government's price-fixing, purchasing and priority agencies. The effort will be to make the present purchasing agencies, particularly the committees of the Council of National Defense, more responsive and more responsible. In particular, governmental leaders at Washington want some participation of governmental agencies, or a governmental agency, in the letting of contracts for the Government. In all likelihood, it may be stated upon high authority, this participation will be that of the Federal Trade Commission. On the other hand, it may be that the President himself, through a small group of men closely associated with him, or, possibly, an individual, may exercise this participation.

Arguments are reaching President Wilson that the present arrangements for purchasing for the Government are far too split up, and that it is necessary to have one strong man in charge of all buying, including determination of apportionment and priority. It is pointed out in Washington that the Priority Committee, numbering half a dozen men, is trying to do the work that about three hundred men ought to do, so great is its volume. In the case of coal alone, between fifty and one hundred telegrams appealing for priority are being received in Washington each day.

Whether the reorganization of the Government's price fixing, purchasing and priority agencies will provide for participation by the Federal Trade Commission or by some individual or group of men especially designated and close to the President, to represent him, remains an open question, and must remain so until Congress completes its proposed legislation in regard to the committees of the National Defense Council, now in the so-called food bill. However, President Wilson will doubtless not consent to eliminating the services of these high-class business men, to whom, he feels, the country owes a great debt for what they have performed in the way of mobilizing industrial resources so far. It is seriously doubted that he will accept any proposal from Congress that slaps at these men. Notwithstanding his statement of a few days ago that there shall be no "blood profits" during the war, it is pointed out that he has urged in a letter to the Senate Agricultural Committee that there shall be no provision in the food bill which would strike at the Council committees.

Operating on Government Account?

Whatever the machinery of the reorganization, the Federal Trade Commission is now preparing for it. There is a distinct tendency in government at Washington now toward the idea of operating on Government account. The Government may yet say to industry, "You run your industry, but as to elements of cost, distribution, and profits, *we* will control." Something of this tendency was seen in the recent report of the Federal Trade Commission to Congress, based upon which a bill has since been introduced in Congress, providing for a pooling arrangement to operate mines and railroads.

It is perhaps not realized that the Federal Trade Commission is now investigating the costs of steel; the subsidiary products of steel; lumber; aluminum; wire nails; bituminous and anthracite coal; zinc; copper; and lead. As one official in Washington expressed it to the correspondent of the *Engineering News-Record*, "there isn't much left in the way of basic materials to investigate." The steel costs are now being completed and the results will be made public in a few weeks. What is to happen then is not yet known.

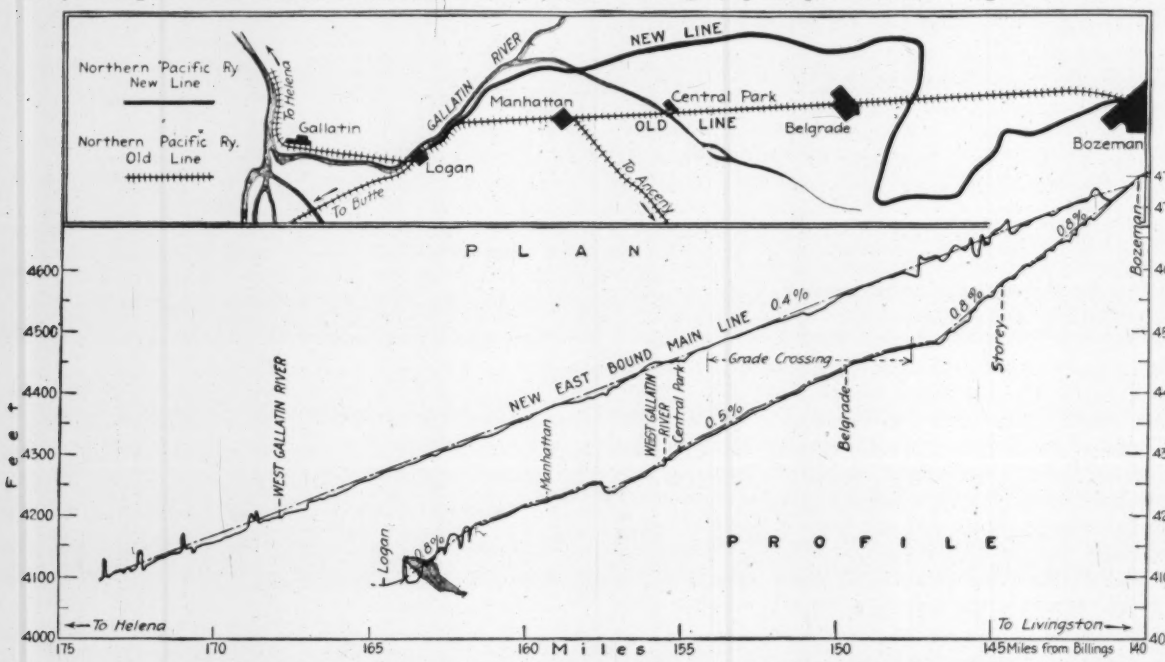
The principal use of the data so gathered would be in price-fixing. Then, on top of that, too, comes the question of abnormal profits, or, rather, the possibility of halting them.

These are radical ideas; but these are radical times England has been all through the same stages.

Seven Miles of Line Added To Reduce Grade

Northern Pacific, on Second-Track Work in Montana, Builds New Line with Ruling Gradient 0.4 Instead of 0.8 Per Cent

TO FACILITATE the movement of its heavy eastbound freight traffic on the Montana division, the Northern Pacific Ry. is building a second line between Logan and Bozeman, Mont., which will have a maximum grade of only 0.4% as against 0.8% on the old line. The latter will continue in use as the westbound track. The easier grade is obtained by developing the line in a curved location so that its length is 33 miles as compared with 24 miles for the old line, which is practically straight. The maximum curvature is 4½°, and the 0.4% grade, which is practically continuous, is compensated at the rate of 0.04% per degree of curve. The situation is shown clearly by the accompanying plan and profiles.



NEW LINE SACRIFICES PRESENT GOOD ALIGNMENT, BUT CUTS OPPOSING GRADE IN HALF

On the 123-mile Montana division, between Helena and Livingston, the eastbound traffic is now handled as far as Logan (74 miles) on the basis of a maximum grade of 0.4%. From Logan to Bozeman (24 miles) the ruling grade is 0.8%, and from Bozeman to Muir (13 miles) it is 1.9%, this latter being operated as a pusher grade. Beyond this there is a descending grade to Livingston (12 miles) with a maximum of 1.8%. At present the standard eastbound trains are reduced from 2375 tons to 1567 tons at Logan, the excess tonnage being handled in extra trains to Livingston.

Traffic Capacity To Be Much Increased

The new low-grade line will permit the operation of standard-tonnage trains through from Helena to Livingston, using pushers (of greater power than those now in service) on the 1.9% grade up to Muir. This arrangement will not only increase the traffic capacity of the division very materially, but will eliminate about 963 turn-around extra trains per annum, now required to handle the excess tonnage between Logan and Bozeman.

The grading is light. Except for a few comparatively small rock cuts, the work consists chiefly of earth embankments, the material for which is obtained from side borrow pits. The only steel bridge—across the Gallatin River—will have four 75-ft. through plate-girder spans. The district through which the line passes is thoroughly irrigated, so that a large number of waterway openings are required. These are reinforced-concrete structures.

The work is under the direction of H. E. Stevens, chief engineer of the Northern Pacific Ry., and S. J. Bratager, principal assistant engineer. E. L. Dorsett, assistant engineer, is in direct charge of the construction. The general contractor for grading and structures is Martin Woldson, of Spokane, Wash. The estimated cost is about $1,500,000, and it is expected to have the line ready for operation in the fall.

Western Wood-Stave Pipe Field Active

Previous to the war, the first cost of wood-stave pipe lines was much below the cost of corresponding steel lines. At present, in addition to the fact that war conditions have increased the price of steel pipe to 30% more than the cost of corresponding wood-stave lines, there is also the difficulty of obtaining prompt deliveries. Consequently, the use of steel pipe in the irrigation and mining field, for example, has dwindled to near the vanishing point. On a recent contract in which an order for $80,000 worth of wood-stave pipe was placed with a California firm, steel-pipe manufacturers refused to bid. This was an irrigation job such as those on which both materials have been heretofore used.

Cast-Iron Pipe Specification Controversy

Manufacturer Members of American Water-Works Association Committee Protest and User Members Reply

Letters from N. F. S. Russell and Walter Wood are answered by John H. Gregory, F. A. Barbour, W. H. Randall and Edward E. Wall—William E. Clow joins discussion

Russell Declares: Editorial Unfair—American Specifications in Almost Universal Use—Change to Uniform Outside Diameter Would Be Costly and Troublesome.

Sir—As a representative of the manufacturers of cast-iron pipe, on the committee of the American Water-Works Association for the revision of cast-iron pipe specifications, I regard as very unfair the editorial note in your issue of May 31, 1917, and believe that the same was written without a thorough investigation of the subject on the part of your editorial staff, in that it presents only one side of the question.

The cast-iron pipe manufacturers on this committee were told by the engineering members of the committee that the standard outside diameter for all classes of the same size of pipe was the *sine qua non* of the revised specifications, and that unless the makers were prepared to agree to it there was no use of going further with the revision.

It was a question—and is still a question in the minds of the cast-iron pipe manufacturers—whether the engineering members of the committee, in their attitude on the standard outside diameter, correctly represented the feelings of the association at large; in that each city of this country has adopted for its distribution system some one class or other of the American or New England specifications. In this adoption of a class, they automatically have a standard outside diameter for their own distribution system; and the proposed change to a uniform outside diameter for each pipe size would at once cause trouble in many cities and towns, through forcing upon them the adoption of a new or different standard from the uniform outside diameters they have been using so satisfactorily.

American Specifications Almost Universal in North America

Further, in reference to the two standard specifications, may I state, as the manufacturers stated to the committee, the specifications of the American Water-Works Association are almost universal in their adoption. They do not differ materially from the New England and are the standard adopted by the Canadian Society of Civil Engineers, so that they are universal in the North American continent. I can say that over 90% of the cast-iron bell-and-spigot water pipe in this country is manufactured and sold under these American specifications. With this almost universal adoption of these specifications, including of course the tables of dimensions, does the supposition of the manufacturers that these specifications adequately meet the needs of the users of cast-iron bell-and-spigot water pipe, and therefore the question that a change in the specifications should be submitted to the association, justify the remark in your editorial—"the absurdity of such request is equalled only by its audacity."

The manufacturers on this committee, with the full concurrence of all makers, tried to point out to the engineering members not only the manufacturing difficulties entailed by the adoption of a single outside diameter for each size, but also the fact that it would cost a great many thousands of dollars—outlay for the new equipment, changes in plant, etc.—and that it would greatly increase the chance of loss in manufacture because it would increase the use of manual labor and decrease the machine operations; whereas the cast-iron pipe manufacturers have been working to decrease the factor of loss always involved in the use of manual labor.

The engineering members of the committee asked for estimates of the cost involved in making these changes of equipment, etc., but such estimates, under present conditions, could not be made with any reasonable degree of accuracy.

The other proposed changes in the specifications were discussed, but it was the feeling of the manufacturers that—as they were told bluntly by the engineering members of the committee that unless they would agree to the standard outside diameter of all classes of the same size pipe it was useless to go on with the revision of the specifications—any discussion of the other points was profitless.

Radical Change to Uniform Outside Diameter Commercially Impracticable

A comparison of the tables of dimensions of the New England and American and Canadian specifications will show that the proposed radical change to a standard outside diameter for the same size of pipe is not a part of either specifications, which are practically identical as to outside diameters falling under different classes of each size; nor is it a part of any foreign specifications, with the possible exception of those used in Germany.

Is it fair, therefore, in your editorial, to put the cast-iron pipe manufacturers in the position of obstructionists because they object to the making of large capital expenditures and upsetting the processes of manufacture which comply with all present standard specifications, upon a demand which they regard commercially impracticable and feel does not at all represent the desires of the members of the American Water-Works Association, as a whole?

May I ask that you give this presentation of the manufacturers' side of the question as wide publicity as you have already given to the other side.

N. F. S. RUSSELL,
General Sales Manager,
United States Cast-Iron Pipe and Foundry Co.
Philadelphia, Penn.

Wood Urges: Cast-Iron Pipe Sold on Close Margin To Compete with Substitutes—No Deadlock in Committee—Objections to Proposed Uniform Outside Diameter, Chemical Composition Requirements and Relation Between Bending Moments and Flexure in Test Bars.

Sir—I thank you for the reprint from your issue of May 17 in which you speak of the recent convention of the American Water-Works Association at Richmond. We are especially interested in what you say regarding specifications for cast-iron pipe. I have also read your editorial in your issue of May 31 on the same subject of pipe specifications.

Many may think I am somewhat self-sufficient, in what I am saying below, but it does not seem to me wise to let a large subject of this kind get tangled up with careless expressions.

CAST-IRON PIPE SOLD ON CLOSE MARGIN OF COST

The facts are that cast-iron pipe has to be sold on a very close margin of cost, in order to compete with the many substitutes that are offered, the original cost of which is very often misleading to buyers who do not give full consideration to their inefficiency and lack of durability. Notwithstanding all this, users of cast-iron pipe are entitled to have tendered them material made carefully and accurately, so as to insure a good workable product. There are, of course, instances where special contingencies have to be met and special provisions devised to overcome them. This is the province of every great engineer. The normal needs of everyday practice do not require such elaborations or expensive preparation.

There is no "deadlock" between the manufacturers and the engineers. The engineers can issue any specification for any particular requirements they desire, but the manufacturers feel that it would be an injustice to force upon the everyday user of pipe the extra expense of the refinements that might be found necessary in special cases. The manufacturers must insist that the sale of their product is not crippled by unnecessary processes which lead to no definite result—such as are incorporated in the proposed specifications. In self defence, they must insist upon a good "work-a-day" basis.

Your paper speaks of three points upon which discussion has largely centered:

DISCUSSION CENTERS ON THREE POINTS

1. *Uniform Outside Diameter for all Classes of Pipe*—No practical man will, for a moment, suggest that it is desirable to work to a uniform outside diameter for 60-in. pipe. On the other hand, it is very desirable that the normal variation of weights in 6-in. pipe shall be so adjusted that each different weight will couple with standard fittings. The only question over which any issue can be made is what diameter between 6 and 60 should be chosen as the dividing line. For many years 12 in. and under has been this dividing line, and dimensions of fittings for all sizes, 12 in. and under, are so arranged that they are adaptable either for light or heavy pipe. The question, therefore, resolves itself into this:

Shall 12 in. be now given up as the dividing line between interchangeability and the individuality of diameter?

2. *The Chemical Composition of Iron*—This is largely a question of geography, adding thereto the thickness of the shell of the pipe. Most excellent pipe is made from iron that manufacturers upon the Delaware River would consider most peculiar and most unusual. Analyses of the metal do not determine, except within the very broadest limits, the value of pipe. The worth of a pipe is determined by its ability to stand hydraulic pressure and not by moderate variations of percentages of metalloids. We refer to this point as being a "geographical" one, because the different analyses of pig iron that is used for making entirely satisfactory pipes (all the way from Russia through America to China) depend upon the character and variation of ores found in the different countries.

3. *The Relation Between Bending Moment and Flexure in Test Bars*—This is something about which even the most experienced know, as yet, very little. Hence, it is dangerous to put into specifications for daily use any thoughts and anticipations that are not fully understood or developed.

So much for the various points you bring up. There should be no "deadlock" on the part of engineers and everyday buyers. Each should have what best suits their requirements.

In conclusion: Let everyday buyers have a guaranteed and satisfactory quality of pipe, such as they have secured for years under the American Water-Works specifications. This is the question that should come up for discussion in the association. Further, no engineer should be limited in making peculiar requirements, even if they cost money. But such requirements, needed for special cases, should not be worked into general specifications and increase for the everyday user the cost of a material that is already satisfactory, and who wants simply a good article that will stand *hydraulic* pressure.

WALTER WOOD.
Philadelphia, Penn.

The Editor Remarks in Passing: That he Knew Both Sides of the Case—That "Absurd," "Audacious" and "Deadlock" were used advisedly—and that the Engineer Members will do their Own Talking.

[The editorial note referred to in both the foregoing letters was written with full knowledge of the report presented at Richmond and the ensuing discussion. We characterized as absurd and audacious, not any objections the manufacturers may have to the tentative

draft of cast-iron pipe specifications, but the proposal to suppress the draft and ask the members to vote in the dark, by letter ballot, on whether they wanted the specifications changed when for six years the association has maintained a committee for the express purpose of revision. Mr. Wood says there is no deadlock in the committee. We characterized the condition as "deadlock by courtesy," since the four engineer or pipe-consumer members have long waited on the two manufacturer members of the committee. So much for our own part. The portions of the letters by Messrs. Russell and Wood that relate to the work and attitude of the two elements in the committee we leave to the engineer or pipe-consumer members of the committee, Messrs. Gregory, Barbour, Randall and Wall, whose joint communication on the subject appears below.—Editor.]

The Four Consumer Members Present "Some Facts": No Attempt To Force Specifications on Manufacturers—History of Efforts To Get Makers To Coöperate—Uniform Outside Diameters Once Urged by Manufacturers—What Would Changes Cost?

Sir—We thank you for bringing to our attention the foregoing letters of Messrs. Russell and Wood. While the undersigned, who are referred to by Mr. Russell as the "engineering members" (of the American Water-Works Association Committee on Revision of Standard Specifications for Cast-Iron Water Pipe and Special Castings), have no desire or intention of entering into a controversy through the columns of your paper, there are some facts which your readers should have before them when considering the letters above referred to.

It may be well to say right here that the uniform outside diameter was by no means the only important point discussed at the conferences over these proposed specifications. And it may further be said, with reference to uniform outside diameters, that the indications were that the cost of securing the same would be nominal, to say nothing of the fact that the manufacturers formerly urged the adoption of uniform outside diameters.

The preliminary draft of proposed new standard specifications, which was submitted to the manufacturers for their consideration, was printed in *Engineering News-Record*, May 31, 1917, and is therefore available to all who may be interested in the subject.

No Attempt To Force Specifications on Makers

With reference to these specifications, it should be stated most emphatically that they were *tentative* only, and in our communications to the manufacturers this was emphasized. In other words, the committee has never taken the attitude of attempting to force anything on the manufacturers. The committee, in response to what it believed to be the intention of the association in appointing it, adopted the uniform outside diameter. Then it went a step farther and added a relation between flexure and breaking load. Then, it undertook to add to the specifications the chemical characteristics of the metal, and finally it incorporated a specification for improved coating. These were the principal changes.

In this work of drafting a new standard specification the ideas mentioned above, as well as others of minor importance, were put up for discussion, and not a letter has been written to the manufacturers which has any other significance than an expression of the desire of the committee to obtain the necessary information from the manufacturers which would prove whether these ideas—taking into account cost and workability—were practicable.

History of Attempt To Get Makers To Coöperate

The history of our attempt to get the manufacturers to coöperate with us and give us the benefit of their experience will be of interest.

On May 7, 1916, the preliminary draft of the proposed new specifications was sent to the manufacturers, and from the letter accompanying the same the following paragraphs are quoted:

"The inclosed specifications for cast-iron water pipe and fittings, prepared by a joint committee formed from the committees of the American and New England Water-Works Associations, is a preliminary draft of proposed new standard specifications and is sent you for your criticism and discussion."

"It is the intention of the joint committee to hold a meeting in New York within a few months, and to invite manufacturers to appear and present in person their discussion of the inclosed specifications, or if attendance is not possible, to submit such discussion in writing at this meeting, notice of the time of which will be given thirty days in advance of the date finally chosen."

"It is to be understood, however, that the present draft is altogether tentative, that the minds of the committee are open, and that this draft is now sent you for your discussion and criticism, with the hope that finally a standard specification may be developed, acceptable throughout this continent, at least, to the users and to the manufacturers of pipe, and which will become effective at such time in the future as will reasonably allow for any necessary changes in foundry equipment."

Manufacturers Unanimous for No Change

Subsequent to the sending out of the tentative specifications, the following letter, dated June 5, 1916, and signed by the manufacturers and addressed to the chairman, was received:

"The revision of the A. W.-W. A. specifications submitted by your committee has been carefully considered by all makers of cast-iron pipe, who now have the honor to report that in their opinion the specifications submitted are not practical from the standpoint of the maker—that the A. W.-W. A. specifications adopted May 12, 1908, have been complied with by all makers, at an enormous cost in fixed capital, and the pipe made under these specifications has proved satisfactory for the purpose for which it is intended, and all makers are unanimous in their firm decision to continue producing under the A. W.-W. A. specifications now in general use."

Notwithstanding the apparent attitude of the manufacturers, we felt that they would still comply with our

request for their discussion and criticism of the tentative specifications. Accordingly, on Nov. 23, 1916, an invitation was sent to the manufacturers to meet the joint committee (of the A. W.-W. A. and N. E. W.-W. A.) in New York on Dec. 14, 1916. Such a meeting was held, on the date mentioned, at which representatives of the manufacturers, as well as members of the committee, were present.

Makers Requested To Discuss Draft in Detail

At this meeting there was much discussion (the stenographic report covers 128 typewritten pages), especially of the proposal to adopt a uniform outside diameter and of the feasibility of specifying the chemical quality of the metal. It became evident that the manufacturers, as represented at the meeting, were opposed to the revision of the present specifications, for various reasons, including the expense incident to changes in present equipment, increased manufacturing difficulties, and the belief that the present specifications were good enough. In order that the statements of the manufacturers as to the effect of the proposed changes on cost of production and on the technic of manufacturing might be supported by definite figures and arguments, the following motion was unanimously carried, there being seven members of the two water-works associations' committees and six representatives of the manufacturers present at the meeting:

"Moved, that the manufacturers be requested to consider the tentative specifications for cast-iron pipe as prepared and submitted to the manufacturers under date of May 7, 1916, and report to the committee at a meeting to be held on Mar. 15, 1917, the result of their deliberations, with such modifications of the specifications, paragraph by paragraph, as may seem to them desirable, together with their reasons therefor."

Makers Decline Further Discussion

It was the understanding of those present that the manufacturers would discuss in detail the tentative revised specifications, and would present in writing at the meeting to be held on Mar. 15, 1917, the results of their deliberations.

When the date of this meeting approached, it was found that the manufacturers were not prepared to submit any detailed discussion of the tentative draft of specifications. No meeting was held, but the following letter from the manufacturers, dated Mar. 30, 1917, and signed by Walter Wood and N. F. S. Russell, was received by the chairman of the committee:

"Referring to the request of the committee that the manufacturers should again study the tentative specifications submitted by the joint committees of the American Water-Works and New England Water-Works Association, and if necessary to propose their own specifications:

"We beg to state that this question has been fully discussed at three meetings of the manufacturers, and it is the unanimous opinion that there are no essential changes, at the present, necessary in the specifications of the American Water-Works Association, adopted May 12, 1908.

"These specifications are not ideal, but for practically ten years have proved fairly satisfactory to both user and manufacturer, as evidenced by their almost universal adoption.

"We would, therefore, respectfully suggest that the specifications of the American Water-Works Association, as now drafted, remain unchanged."

The preceding letter makes evident the position of the manufacturers and the fact that they not only will not agree to any changes in the present specifications until forced to do so by the demand of the consumers, and will not even coöperate with the committee to the extent of furnishing detailed reasons and figures in support of their objections to the proposed revision.

A report was then made by the committee to the American Water-Works Association at the convention held in Richmond in May, 1917, at which the conditions of affairs was brought to the attention of the association.

Specifications Not To Go Into Effect for Years

With reference to the time when the proposed specifications should go into effect, should they be adopted with or without changes, we recognized the existing abnormal conditions in the country, and in our report to the convention we stated that "it is not proposed these specifications should go into effect for a number of years"; and the representatives of the manufacturers are well aware that all along we have been of the opinion that revised specifications should not become effective until some time in the future, as stated in our letter to the manufacturers dated May 7, 1916.

As bearing on one phase of the matters under discussion—namely, the cost involved in having a uniform outside diameter—Mr. Russell, at an early meeting of the committee, in response to the question of cost, estimated the investment necessary to make the changes needed, and when this was figured into tonnage per year it amounted to less than 5c. per ton. The estimate, made on the moment, was probably only a very rough one. The committee has subsequently endeavored to obtain accurate figures from the manufacturers, which unquestionably are at their command, and which, also unquestionably, the manufacturers have simply refused to furnish.

Makers Once Urged Uniform Outside Diameters

As bearing on the matter of uniform outside diameters, the following quotation from a letter dated Dec. 1, 1913, and written by L. R. Lemoine, President, United States Cast-Iron Pipe and Foundry Co., to D. Long Miller, Louisville, Ky., a former member of the A. W.-W. A. committee, and forwarded by Mr. Miller to the chairman on Jan. 5, 1914, is of especial interest. Mr. Lemoine is discussing some of the early work of the committee and especially a memorandum in which uniform outside diameters were proposed, as well as discussing the American and New England Water-Works Association's specifications. Mr. Lemoine says:

"These New England specifications, by the way, were adopted Sept. 10, 1902. Prior to the adoption of these first standard dimensions, the manufacturers represented at the conferences with the committee of the New England association urged uniform outside diameters for the several classes of pipe for each nominal inside diameter. This ideal was then overruled by the

engineers, resulting first in the New England standard dimensions and later in the American tables. Since then, the manufacturers have made up fixtures for pipe as thus specified. To change now would involve large outlays for new equipment which the manufacturers listed above [a list of ten manufacturers was given], including this company, are not prepared to make. At the moment, it is not necessary to go into the details of these changes."

Here we have, then, a statement from one of the largest manufacturers of cast-iron pipe that a uniform outside diameter for the several classes of pipe for each nominal inside diameter is ideal and that its adoption was urged by the manufacturers as long ago as 1902, but that the engineers, then in charge of drafting the specifications, turned the proposition down at that time. In fairness to the undersigned it should be stated that none of us was connected with the writing of the original specifications of either the American or New England Water-Works Associations.

How Much Would the Proposed Changes Cost?

That the manufacturers have installed equipment to turn out pipe in accordance with the present American and New England specifications is not denied, and that it will cost money to make changes so as to turn out pipe with a uniform outside diameter for all classes of pipe of the same nominal size is admitted. What we want to know is how much will it cost to make these changes and go back to the ideal urged by manufacturers 15 years ago. The manufacturers can tell us, and we've asked them to, but they won't.

With all of the above before the readers of *Engineering News-Record* we are perfectly willing to leave them to form their own judgment as to whether the engineering members of the American Water-Works Association Committee have been unreasonable or not.

John H. Gregory,
Consulting Engineer, New York City.
F. A. Barbour,
Consulting Engineer, Boston, Mass.
W. H. Randall,
Superintendent of Maintenance and Distribution, Toronto, Ont.
Edward E. Wall,
Water Commissioner, St. Louis, Mo.

Mr. Clow's Letter Comes Just in Time To Give Manufacturers Another Inning—Hits Hard at Editor and Engineers—Cost of Changes Discussed—Are Pipe Makers Audacious Obstructionists or Have They Broader Viewpoint Than Engineers?—A Last Shot at Substitutes for Cast-Iron Pipe.

Sir—I have been accustomed to look upon the articles in *Engineering News-Record* as authoritative. Your editorial in the issue of May 31 can only be characterized as grossly misleading and absolutely unfair, and unless admitted I shall not believe it was written by your editor or even seen by him, for it is an absolutely false statement.

The demands made on the manufacturers are in part absolutely impracticable. Cast-iron pipe as made has given better satisfaction in use than any other material. Its life is unknown—its record stands now for over 250 years of constant service. No substitute for cast-iron pipe has a record for good service of even 25 years..

Cast-iron pipe is now, and always has been, sold at an unreasonably low price based on pig-iron cost and conversion. Some engineers, who are most loudly clamoring for changes that could not be complied with in any pipe shop now in existence in this country, will accept a substitute for cast-iron pipe which is obtainable at the lowest cost and recommend its use to a council that seldom knows the difference in actual value between the only conductor tried and not found wanting and the substitute, which has, so far, always failed.

Never since cast-iron pipe was made has it been so carefully manufactured as now. The makers maintain at their works expensive laboratories where they employ good chemists. Iron is bought on analysis and rechecked when received. All of this is new—it is not 25 years since the first chemist was employed by a cast-iron pipe maker.

Old Specifications Cost Makers a Million

The American Water-Works Association specifications cost the makers of cast-iron pipe at the very least one million dollars—covering necessary changes to comply therewith—and today, to satisfy the wish of a few men, we are asked to discard a part of this equipment and spend another fortune, and are *told* we can add it onto the price.

A few engineers insist that the essential feature of the new specifications is the adoption of a uniform diameter of all classes of pipe of the same size. In the first place, this would mean that standards established for years would be changed. Every city in the country has standardized on the class of pipe of the different sizes which they must use. Under the new specifications this would be greatly complicated and secure no greater uniformity than is now obtained.

Would Cost Each Plant a Quarter Million

Next figure the cost of the necessary change. The equipment to produce pipe in any modern plant cannot be made today for under a quarter of a million dollars. The new specifications mean that a large part of this equipment must be scrapped to attain an end that will in no way improve conditions, will in no way increase efficiency of cast-iron pipe for the use for which it is intended—namely, to conduct water and gases underground.

To develop the greatest efficiency in producing cast-iron pipe has required years of patient study by manufacturers—to produce the best pipe possible—with the lowest labor expenditure and the lowest total cost.

To comply with these new requirements this work would go for nothing—the manufacturer would have to start all over again on a problem which would necessarily require more labor and therefore greater cost to obtain a product which would in no way be an improvement over what we now have.

Why should you write such an uncalled-for article with only one side of the question before you? Why

did you not ask for the makers' side if you cared to enter the controversy? Are the makers simply audacious obstructionists or have they not tried to look at the matter from perhaps a broader viewpoint than a few technical engineers, who at times mistake the use of cast-iron pipe and imagine that they are drawing the specifications and inspecting rifles instead of water pipe?

I write feelingly on this subject, for we have had an eminent man with a reputation inspect our pipe and measure it with a micrometer gage. The experience with this highly educated man, who never had seen the inside of a pipe shop, cost this company many thousands of dollars.

I am sure 90% of all users of cast-iron pipe are well satisfied with the product they receive—the best cast-iron pipe ever made in this country, suitable in every respect for the uses for which it was intended. And why should 90% be burdened because men who specify 10%—but do not pay for it—want to add materially to the cost of production without adding anything whatever to its value for its probable use as a conductor of water and gas?

Do you not believe that *Engineering News-Record* owes it to the manufacturers of cast-iron pipe to give as wide publicity to their side of the question as has been given by your article in the issue of May 31? We sincerely trust you will do so.

You will please pardon my delay in writing this letter. Unusual conditions have prevented, but my intentions—like those of the engineers who are clamoring for this change—are good.

MISERABLE GOOD-FOR-NOTHING SUBSTITUTES

One other thought for you. Do you realize that there is not one single trade paper in the United States that has the nerve to come out and condemn substitutes, the use of which has ruined corporations and impoverished communities? Do you realize that not one of them dare, or do you in your paper, give records of such cities as Hammond, Ind., where the entire water-works was laid with steel pipe and all of it had to be torn up and replaced with the only known conductor of water and gas that has a life justifying its use by any community? I say to you that when you have a commodity suitable for the purposes for which it is intended, lasting, in absolute tests and use, for over 250 years and still good, there is little fault to be found with it; and your best service to the country and to the people is in not condemning the tried and not-found-wanting commodity but, rather, the substitute that is foisted upon an unsuspecting public whose money is wasted and where few people profit. Millions upon millions of the people's money have been wasted on miserable good-for-nothing substitutes, advocated by engineers and guaranteed by them. Before you again condemn cast-iron pipe search the entire world and see if you can locate any losses occasioned by its use that are in any way comparable to the vast fortunes that have been lost by the use of substitutes.

I trust that hereafter your columns will be fairer to the manufacturer, who is struggling at all times to perfect his product, rather than so one-sidedly favor the man who does not spend his own money, whose education is theoretical and not practical, and give fair credit where credit is due.

W. E. CLOW,
Chicago, Ill. President, James B. Clow & Sons.

The Editor Has the Last Word: He Assumes Full Responsibility, States His Object and Declares It Achieved in Unhoped-for Measure.

[Neither the office boy, the printers' devil nor anyone else but the editor wrote the editorial in question. No one asked the editor to write it, or to write or to print anything on the subject, or knew in advance of publication that the editorial note and the tentative draft of specifications were to appear in our columns.

In printing what we did we had but a single purpose. Our object was, not to take one side or the other on the merits of the proposed specifications, but merely to give publicity to them and to the committee "deadlock by courtesy"—and to do it while the subject was fresh.

That object has been achieved in even larger measure than we had hoped—especially by means of the foregoing letters representing both sides of the case.—Editor.]

Inspect Six-Mile Tunnel by Automobile

In the past the inspection of the Gunnison tunnel by the United States Reclamation Service engineers for the reading of gages, etc., has been a trying day's work on account of the long hike and necessity of carrying ladders and blueprints. Early in April the cross-ties were completely removed from the tunnel for the first time and the rails laid against the side of the tunnel. Fred D. Pyle, project manager, and L. J. Foster, office engineer, states the *Reclamation Record*, decided to make the trip by automobile. It was a muddy, sloppy day, and some difficulty was found in lowering the car into the Portal cut. However, the going was good after entering the tunnel, and the trip through was made in 65 min., notwithstanding engine trouble due to splashing water and damp atmosphere. The machine was turned at River Portal without leaving the tunnel, so that a 12-mile run was made under the mountain. On Apr. 27 another trip was made by the project manager and J. H. Fertig, construction engineer, in 38 min. going to River Portal, and 48 min. back to West Portal. The river gates leaked considerably, and the run was made in 4 to 16 in. of water. The maximum speed attained was 12 miles per hour. No engine difficulties were encountered this time. These trips demonstrated the practicability of using an automobile for inspection work on automatic gages, minor maintenance work and transportation of supplies to gate tenders at River Portal.

Metropolitan Traffic Density in War Areas

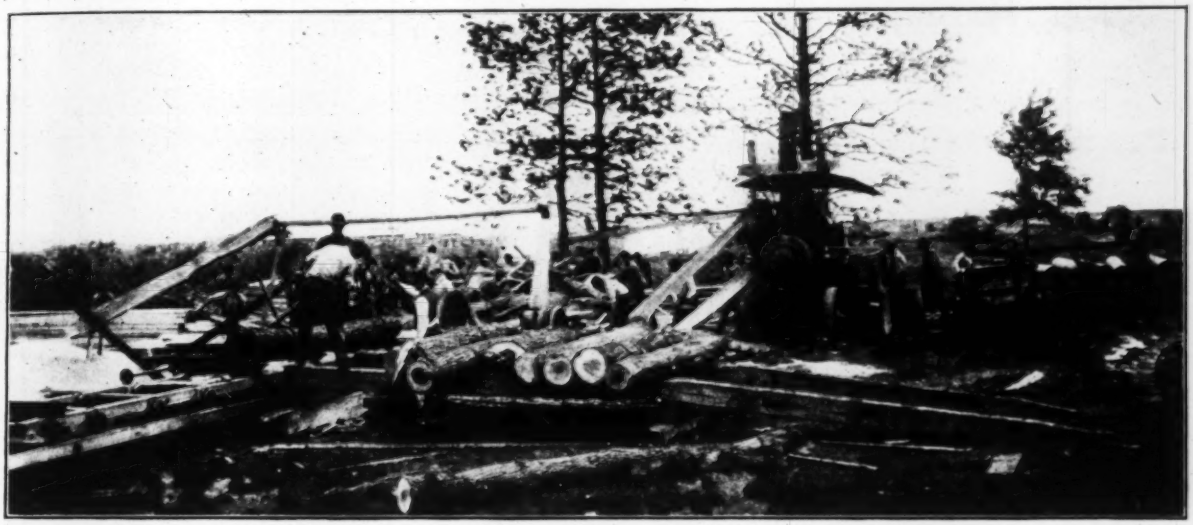
The density of traffic on Fifth Ave., New York City, is equaled, if not actually surpassed, by that which exists over a wide area on the French front. There the traffic includes passenger cars, ambulances, quartermaster trucks, ammunition trucks, artillery tractors, special apparatus for engineer and signal corps, motorcycles and half a dozen other types of vehicle.

Build Army Aviation Camp Near Detroit

Contractor Converts Trees Cleared from Site Into Plank Roads—100 Men Hired Daily To Keep Up Force

TURNING a square mile of land at Lake St. Clair, 30 miles north of Detroit, into an army aviation field and cantonment has required a variety of construction work carried on with speed and proper coordination. A hundred new men are hired every day to maintain the working force of 1000, because of unsettled labor conditions. To build roads across soft ground for delivering construction materials, sawmills were set up on part of the site which required clearing, and the trees were sawed into plank and slabs for roadmaking.

A tent logging camp had been established to clear and stump 13 acres of large timber on the site; and as green timber is perfectly good material for plank roads, the contractor solved his difficulty by setting up two sawmills with a capacity of 14,000 to 16,000 ft. a day and converted the standing timber into road metal. The timber, practically all of which is of logging size, is cut down in the usual way, and the logs are dragged to one of the sawmills by team. The planks, slabs and sawdust produced are all used in making roads. The planks are laid flat without covering, alternate sections of planks and slabs being placed. The slabs are covered with the sawdust to produce a more even surface. The stumps on the land cleared are being removed with dynamite.



PORTABLE SAWMILLS CONVERT STANDING TIMBER INTO PLANK AND SLABS FOR TEMPORARY ROADS

Cantonment Two-Thirds of a Mile Long

Part of the 700 acres selected for the camp site was a wooded flat bordering the lake. It had to be cleared of trees, and underdrained. A dike and a dredged ditch were required in this work. The cantonment proper, a small wooden city covering an area 600 x 3500 ft. down the center of the reservation, had to be provided with water, sewer and lighting systems and with paved streets. For the camp alone, 4,500,000 ft. of lumber was needed.

Until a railroad track could be built 3½ miles to the work from Mt. Clemens, all material received by rail was brought down the Clinton River on barges to the site. Some of the materials were brought by lake steamer; but because of shoal water offshore, these cargoes also were lightered to the camp.

To distribute the lumber and supplies by team proved difficult because of the marshy ground, and a caterpillar tractor, hauling two or three wagons at a time, was soon at work. Even this mired, and temporary roads became an immediate necessity.

The ditches for the underdrainage are being constructed as the building work progresses, and hand labor has been employed so far. A sanitary sewer system discharging into a sump from which sewage will be pumped into the lake is required, and the single valve filter through which the water-supply for the permanent camp will pass from the lake has already been installed to furnish water for the construction camp. The concrete required for this work and for a large number of small footings is being mixed in five portable 10-cu.ft. mixers.

Construction Gangs Drawn from Contractor's Organization

The general contractor for the camp was able to secure a good crew of Michigan lumbermen who have stuck by the job. For constructing the camp buildings, the carpenter forces of this company, trained in

FIVE SMALL MIXERS USED FOR SCATTERED CONCRETE YARDAGE IN FOOTINGS FOR CAMP 3500 FEET LONG

reinforced-concrete formwork, were available and have acquitted themselves well. A competent highway organization has also been assembled for the paving work. The chief trouble with the labor, therefore, was in securing common workmen, who, according to the contractor, come and go at the rate of 10% of the total force employed each day. Hundreds of men come out to the job from Detroit and never go to work. Negro, foreign and American labor is employed.

Some of the skilled and unskilled workmen living in the vicinity prefer to travel back and forth to work every morning in spite of a 5-mile walk to the nearest car line, but most of the force is housed at the job. The lumbermen are cared for in a tent camp, while a temporary construction camp has been built for the other men. As the size of the force increased and the first of the permanent camp buildings were erected, temporary bunks were installed in them for the use of the contractor's forces. The main mess kitchen at the site employs 40 to 50 men to serve three meals a day.

EVEN SAWDUST UTILIZED ON PLANK ROADS

Two 10-hour shifts were started as soon as possible, the entire camp site being lighted by a double line of 600-cp. electric lamps put up by the Detroit Edison Co. on poles 150 ft. apart.

The officer in charge of work for the Government is Capt. H. R. Eyerick. Albert Kahn, of Detroit, is consulting architect on the work, while the construction is being carried out by the Walbridge-Aldinger Co. Mr. Walbridge and J. H. Ryan, purchasing agent for the company, make their headquarters at the camp. Under their direction, E. Winters is superintendent of construction.

How Are Vertical Loads Distributed Through Earth-Fills?

Tests Made by Office of Public Roads and Rural Engineering Give Method of Finding Spread of Concentrated Load

IN A paper presented to the American Society for Testing Materials at the recent Atlantic City meeting, A. T. Goldbeck, of the United States Office of Public Roads and Rural Engineering, outlined some tests where the distribution of vertical loads through sand-fills up to the depth of 5 ft. was measured by readings on sensitive gages, and as a result certain tentative figures for the distribution of such loads were arrived at. For larger range of depths and fill material, further tests will have to be made.

The apparatus consisted of a bin in the bottom of which were placed, at measured intervals, a number of cells which communicated to outside gages and which by an air-pressure device gave fairly exact readings of the pressure produced at each cell. The device was described by Mr. Goldbeck at the 1916 meeting of the society. A bearing block made of a circular plate, in one case 8 in. in diameter and in another 13½ in., was placed on top of a varied depth of fill, and a measured load was applied to the block. Measurements of pressure were then taken through the cells placed at the distributed points below the fill. Data were recorded by diagrams of which a typical one is shown in Fig. 1.

In applying such curves to practical design, Mr. Goldbeck makes the following recommendations:

It is very common practice at the present time to assume that a wheel load acts over a definite area on top of the fill, that the pressure is transmitted with uniform intensity to the slab and that it acts over an area determined by an assumed angle of spread from the top

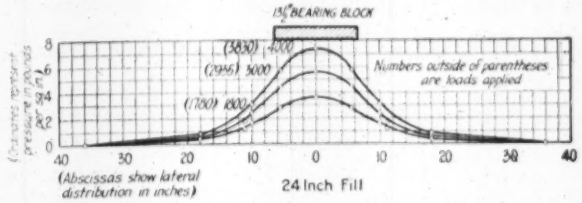


FIG. 1. DISTRIBUTION OF LOAD THROUGH DAMP SAND-FILL

of the fill. This assumption of uniform intensity is of course wrong, as shown by these pressure measurements, but forms a convenient means of calculation, provided the correct intensity and area of pressure are assumed. In order to make use of the curves of pressure for practical calculations of bending moment, it would be well to know the location of the center of gravity of the half-volume of the figure generated by revolving the curve about its central axis. The distance from

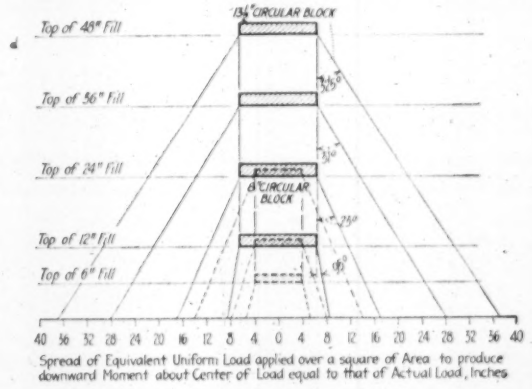

13½" CIRCULAR BLOCK
Top of 48" Fill
Top of 36" Fill
Top of 24" Fill
8" CIRCULAR BLOCK
Top of 12" Fill
Top of 6" Fill
Spread of Equivalent Uniform Load applied over a square of Area to produce downward Moment about Center of Load equal to that of Actual Load, Inches

FIG. 2. LOADS IN TERMS OF EQUIVALENT UNIFORM LOADS

the center of gravity to the center of the curve, multiplied by one-half the total load, is the moment about the wheel load of the distributed pressure to either side of that load. The centers of gravity of these half-volumes

TABLE I. LOCATION OF CENTER OF GRAVITY OF HALF OF PRESSURE ON SLAB WITH RESPECT TO CENTER OF LOAD

Depth of Fill, In.	8-In. Block Load, Lb.	8-In. Block Center of Gravity to Center of Load, In.	13½-In. Block Load, Lb.	13½-In. Block Center of Gravity to Center of Load, In.
6	1,400	2.6		
12	1,200	3.6	1,800	4.4
			5,000	4.2
24	1,400	7.0	1,800	10.5
			4,000	8.4
36	1,400	16.8	1,800	16.0
			5,000	14.0
48	.....	.....	5,000	18.5

for the maximum loads applied to the various depths of fill have been calculated and are shown in Table I.

If for the convenience of the designer, the pressure at the bottom of the fill is considered uniform and acts over a square of area, the sides of each of these areas will be equal to the values in the last column of Table I multiplied by four. The sides of the squares of areas thus obtained are somewhat different for the highest and lowest loads applied and may be tabulated as in Table II.

The results in Table II, for the high loads only, are shown graphically in Fig. 2. In calculating the bending moment in a slab, the designer, instead of using the varying intensity of the load, as it is shown to exist in the pressure measurements, may consider the same total pressure applied over a square of area whose side is given in Table II or as shown in Fig. 2.

TABLE II. EQUIVALENT SQUARES OF AREA

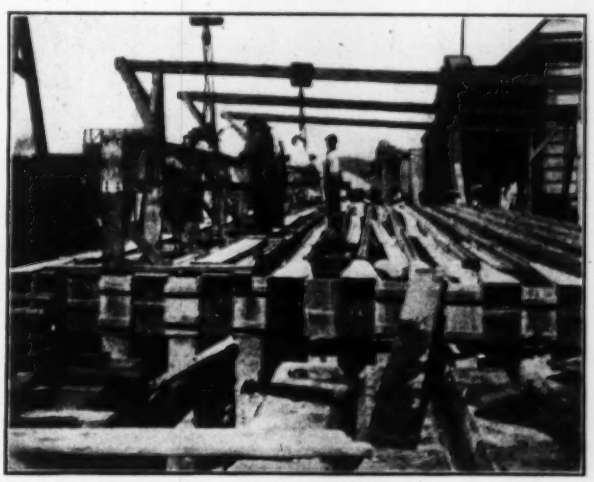
Depth of Fill, In.	Load on 8-In. Block, Lb.	Length of Side of Square of Uniform Pressure Area, In. 8-In. Block	Length of Side of Square of Uniform Pressure Area, In. 13½-In. Block	Load on 13½-In. Block, Lb.
6	1,400	10.4		
12	1,200	14.4	17.6	1,800
			16.8	5,000
24	1,400	28.0	42.0	1,800
			33.6	4,000
36	1,400	67.2	64.0	1,800
			56.0	5,000
48	.....	.....	74.0	5,000
60	.....	.....	.....	

Good Construction Record in Casting Concrete Piles

With Half-Yard Mixer Construction Crew Pours 2000 Linear Feet of Piling in an 8-Hour Day

IN PLANNING the construction of piers 31 and 33 on the San Francisco waterfront, 1293 concrete piles ranging in length up to 90 ft. were required. The contract was awarded with a bonus and penalty clause attached, and the contractor made every effort to organize the work in such way that the maximum rate of progress could be maintained.

The space available for casting and storing the piles measured about 85 x 900 ft., and the construction-scheme layout provided for pouring one layer of piles on top of the other up to a height of four tiers. There



MAKING UP CAGES ON THE FOURTH TIER

was sufficient time for curing, so that the age difference between the bottom and the top layers would be immaterial when the time came to remove the piles from the casting yard and drive them.

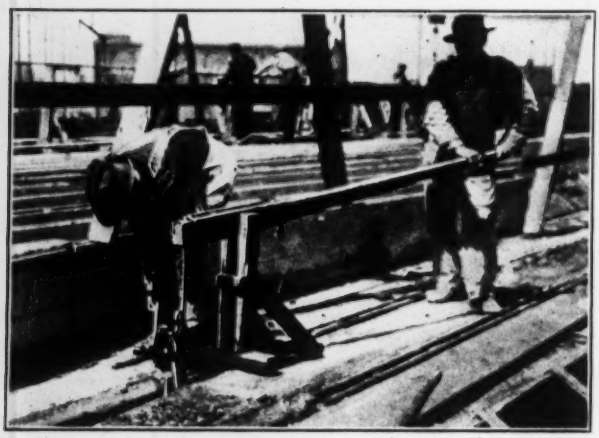
The casting yard was laid out with the mixer plant about midway. Sand and gravel from barges were de-

livered by grab bucket into the bunkers, and cement was delivered in freight-cars on a siding adjacent to the mixer. From the mixer a plank runway 8 ft. wide was built to accommodate the 6-cu.ft. hand buggies. To deliver the concrete, these buggies traveled a maximum of 500 ft., averaging about 300 ft. for the entire job.

Making Up the Cages

The reinforcing steel used in each pile was assembled on the longitudinal rods suspended from gantries immediately over the section of forms being built up. The cages for the 90-ft. piles were supported at four points by chain blocks arranged to travel transversely across the forms. After assembling the cage, the crew of four, one at each supporting chain block, moved it along the gantries and placed it in the form.

The plan of construction was to build the forms tier upon tier as the work advanced, using the ends and sides of forms repeatedly for successive tiers. The side forms on each pile were separated by wooden spacers placed every 2 ft., which could be pulled out when the forms were to be removed, thus taking the strain off the side forms and allowing them to be lifted easily.

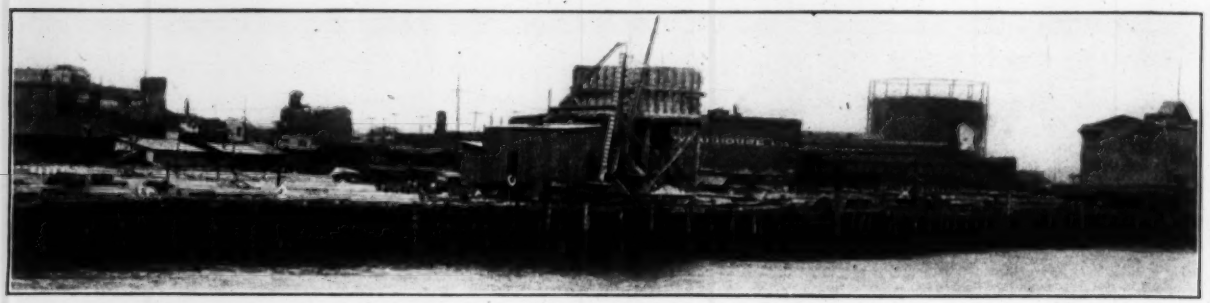


WITH THIS DEVICE SPACERS WERE PULLED FROM BETWEEN FORMS

These spacers were pulled out by means of a pair of flat-jawed tongs operated by a long lever. The jaws of the tongs were made to grip by means of a steel cable, one arm of which ran around a wheel on the other arm and thence over the end of a lever. Ordinarily, two men operated this device, one to adjust the tongs and tap the spacer free with hammer, if necessary, while the other operated the lever. After the forms had been removed from each tier of piles and had been soaked with water at frequent intervals for seven days, another tier of piles was poured on top.

Labor and Materials

For pouring concrete, the usual crew consisted of one man operating the mixer, thirteen concrete men, six laborers and one finisher. In addition to this, a carpenters' crew required to keep the formwork ahead of the concrete gang varied from two to six carpenters and two to eight laborers working under the direction of one foreman. It was found that the crew of housesmiths who could make up the reinforcing cages to best advantage consisted of about thirteen men and one foreman. The usual day's work for this crew was about 18 to 22 cages, 82 to 72 ft. in length.



THE SPACE AVAILABLE FOR CASTING AND STORING THE PILES MEASURED ABOUT 85 X 900 FEET

There were also men unloading cement and a stationary engineer operating the grab bucket unloading sand and gravel. However, form carpenters were used on about half-time only, and of course materials were delivered to the mixer plant only as required. With this construction layout served by a ½-cu.yd. Ransome mixer, the crew poured in an 8-hour day from 1700 to 2000 lin.ft. of piles 18 or 20 in. square.

After 37½ working days the contractor reported 532 piles completed, having a total length of 42,051 lin.ft. Of this number, 338 were 20 in. square and had a total length of 27,540 ft., and 194 were 18 in. square with a total length of 14,511 ft., thus making the approximate total yardage placed in 37½ working days 4015 cubic yards.

During the latter part of the work, there will not be the rush construction on pouring which has thus far been carried out, because while the piles now cast are being driven there will be ample time for those to be required later to set the specified length of time. The rule is not to remove forms until the seventh day and to drive piles only after they have set for 45 days.

The work is being done for the California State Board of Harbor Commissioners, Frank G. White, chief engineer. The general contract for the construction of the piers is held by Healy-Tibbitts Construction Co.

Maryland Limits Weight on Tires

The State of Maryland has limited the weight per inch of tire for truck traffic to 650 lb. On a few of the roads specifically named, the limit is placed at 750, and on others at 800 pounds.

Monumental Portal Completed at Approach of Manhattan Bridge

Colonnade of Cut and Sculptured Granite on Center of Plaza at Manhattan End of New York's Latest Suspension Bridge

WHAT is probably the most elaborate and certainly the most expensive bridge portal in the country is now approaching completion at the west, or Manhattan, end of the Manhattan suspension bridge across the East River, New York City. The Manhattan bridge is not new. It was started in 1901 and was opened early in 1910. It was not until the first part of 1913, however, that any work was begun on the monumental approaches to the bridge. The Brooklyn approach is now completed. The Manhattan approach is completed in so far as the main structure is concerned, but work is now under way on the construction of the bridge trolley station and entrance at the south end of the plaza.

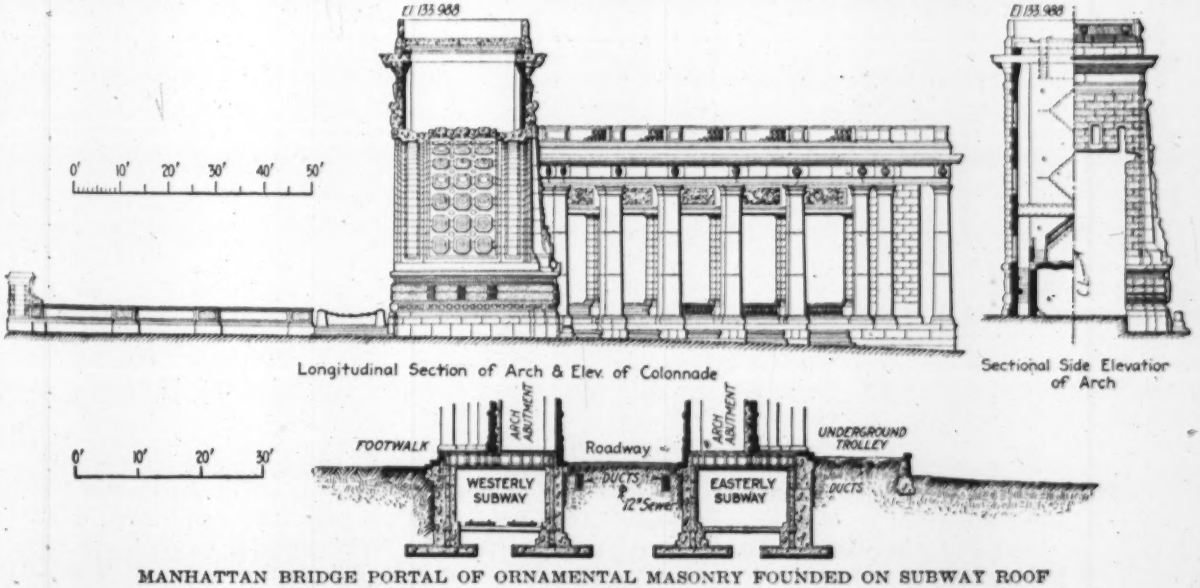
Manhattan bridge reaches street level in the Borough of Manhattan near the corner of Canal St. and the Bowery. There was set aside at this junction an approximate rectangle about 400 x 750 ft. in plan, all of which is devoted to the approach and treated as an architectural and landscape unit, the adjoining streets being shifted in some few places to meet the design requirements of the approach plaza.

Granite Arch the Central Feature

The central feature of the approach is a monumental granite arch with an elliptical colonnade. Between the arms of the colonnade and under the arch passes the main vehicle roadway of the bridge. To the north of the colonnade the through surface cars turn to reach the northern roadway of the bridge, while to the south of the granite structure—that is, in the extreme southerly corner of the approach plaza—is located a terminal for the bridge trolley system, whose tracks cross on the southerly roadway of the bridge. On either side of the colonnade the area is highly parked and terraced, and retained above the level of the adjoining streets by an ornamental granite retaining wall. The footwalks, which are on the extreme north and south of the bridge, are approached from either directly south of the southerly colonnade or from the extreme edges of the plaza.

The arch and the colonnade structure are founded on natural earth and on the prepared roof structure of the

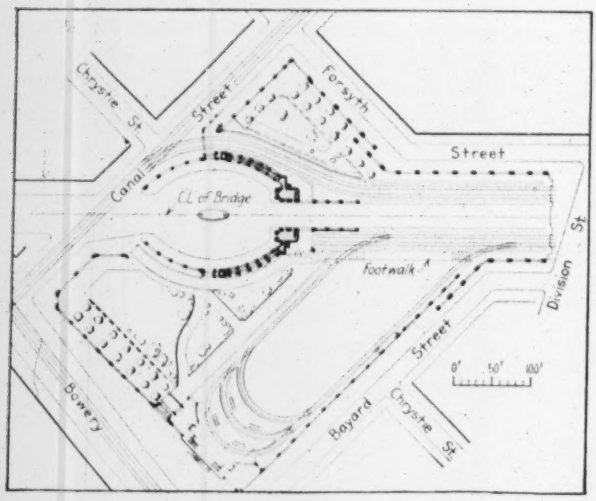
A CLASSIC MONUMENT ON NEW YORK'S EAST SIDE LEADS TO THE MANHATTAN BRIDGE ACROSS THE EAST RIVER



MANHATTAN BRIDGE PORTAL OF ORNAMENTAL MASONRY FOUNDED ON SUBWAY ROOF

and was made up of heavy plate girders spanning concrete retaining walls and themselves incased in concrete.

The main arch is of the monumental arch type made familiar by the Washington arch on lower Fifth Ave., New York, and the Arc de Triomphe in Paris. It is Center St. subway, which comes up under the portal to reach the center roadway of the bridge. The subway was designed to carry the load of the masonry portals



PORTAL IN CENTER OF PLAZA LAYOUT

about 70 ft. high, with an arch opening rising to 40 ft. from the roadway surface, the arch itself being a 36-ft. semicircle. The showing faces are of highly ornamental granite masonry, and the arch rib is of cut granite block backed for stability loading near the haunches with mass concrete. The interior of the arch otherwise is hollow, except for two reinforced-concrete floors and a reinforced-concrete roof, making the whole structure available for storehouse purposes.

The colonnade is made up of classic columns connected by the usual cornice structure. In the two faces of the arch piers and in the space above the arch proper are figures of symbolic and historical interest sculptured in granite. Those on the piers were designed and carved by C. A. Heber. The main frieze is the work of C. C. Rumsey.

All of the decorative stone is from the Hallowell granite quarries in Maine. It was cut to the smallest detail at the quarry and shipped by boat directly to New York. Very little finishing work was done by the stonecutters at the site, and due to the careful work by the contractor, not a single stone was broken or seriously marred in the erection process. This i quite remarkable because of the highly decorative character of a number of the stone pieces, particularly in the cornice of the colonnade and in the soffit of the arch ring. Exceptionally careful work had to be done at the latter place because of the protruding stems of the rosettes, which had to rest directly on the wood lagging of the arch falsework. Practically the whole colonnade and arch were erected from one working platform about the center of the elliptical approach. On this platform were located the derricks, which covered to all practical purposes the stoneworking area.

There are in the colonnade arch and retaining walls about 3700 cu.yd. of ornamental granite and about 1900 yd. of backing granite, together with 1000 tons of structural steel used in reinforcing the arches and foundations. The total cost of the approach structures will run close to $1,000,000. The ornamental granite work cost the city about $100 per cubic yard.

The approach to this bridge was designed by the Department of Plants and Structures of the City of New York; F. J. H. Kracke, commissioner, and E. A. Byrne, acting chief engineer. The architects responsible for the artistic designs and supervision of the approach were Carrère & Hastings, of New York City. The work was done by the P. T. Cox Co., of New York City, under the supervision of J. R. Geoghan, resident engineer.

Help Drain Irrigated Land

Small Wells Relieve Pressure in Substrata—Water Rises To Reach Tile Drains in Soil Underlain by Shale

RISING wells or boreholes sunk below the level of tile drains may materially assist the drainage of irrigated lands that are underlain by shale. This applies particularly to such lands in the Rocky Mountain States, where the water in the shale is under pressure and where methods employed in other sections of the country have not proved successful. Deep tile drains are required, not less than 6 ft., and as much as 8 ft. deep in many cases. The depth to the water-carrying strata, however, is much too great for ditching; and as pressure conditions exist in these strata, the sinking of wells permits the water to rise into the drains.

Owing to the character of flow in shale ground, the area of influence of a relief well is not large, and from two to six wells per 100 ft. of trench may be necessary. Their maximum depth is usually 20 ft. below the drains, and in general the flow is encountered at a depth of about 15 ft. In most cases a 2-in. hole is sufficient to care for the water.

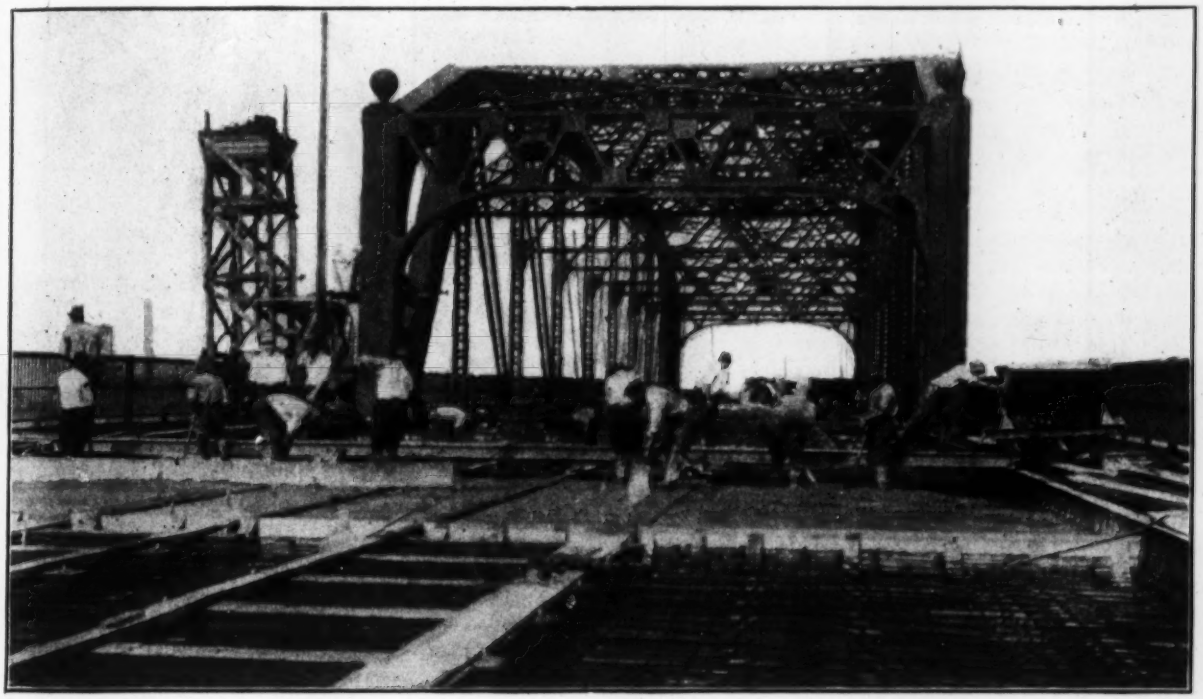
The well should be located near the end of a tile, and one end of the tile then chipped so as to leave a 2-in. hole over the well. If the banks will not stand and the wells must be driven as the tile-laying progresses, the well should be a few inches to one side of the drain and connected to the hole in the latter by placing a half-tile over the well. If the well is directly under the tile, it is likely to be closed by sediment washing into it, especially if the flow is weak.

The cost of boring the wells averages about 5c. per lin.ft. to a depth of 8 to 16 ft. below the trench, or as high as 10c. per ft. for depths of 16 to 25 ft., especially if hard material necessitates drilling. This cost represents an average of 2c. per ft. of drain. The trenching, tile laying and backfilling of drains 6 to 7 ft. deep amount to from 12 to 25c. per ft. (or 14 to 27c., including the wells). These prices are exclusive of the cost of the tile. The cost per acre is high, owing to the frequency of drains in soil of this kind; it ranges from $13 to $100 per acre. The above particulars are from a paper on "The Drainage of Irrigated Shale Land," by Dalton G. Miller and L. T. Jessup, in Bulletin No. 502 of the U. S. Department of Agriculture.

Wide Roadway of Cleveland Bridge Concreted Cheaply

Form Travelers Hung from Stringers—Concrete Delivered on Track Loop Formed by Bridge Over Roadway

A NUMBER of economical methods have been developed in concreting the base for the roadway and sidewalks of the Clark Ave. viaduct in Cleveland. About 5260 ft. long, with a 40-ft. roadway containing two street-car tracks and an 8-ft. sidewalk on either side, the concrete deck of this bridge is supported by steel floor-beams and stringers, the sidewalks being carried by brackets on the ends of the floor-beams. There are railroad lines on which materials could be delivered beneath the viaduct on either side of the Cuyahoga River. The problem was, then, to put a concrete deck on a steel skeleton at a height, for the greater portion of its length, of 70 ft. or more from the ground, the best locations for a concrete plant being on the ground and it being further impossible to get at the forms from above after the concrete had been placed.

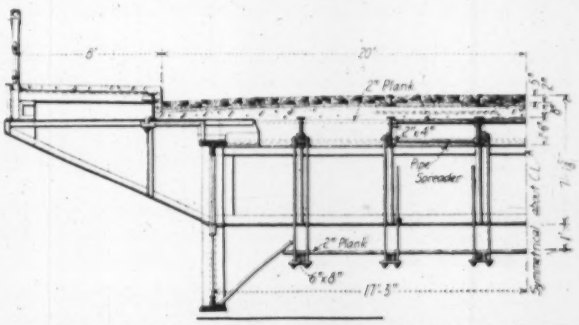


BRIDGE AND CAR SYSTEM PLACE ROADWAY SECTION NEAR FIRST CONCRETE PLANT

Roadway Concreted First

A concrete plant with a hoisting tower reaching the level of the bridge and discharging into a hopper feeding cars on an industrial track was set up at the railroad track on the east side of the river. This installation was used to concrete that end of the bridge, then was moved across the river to the railroad on the other side and used to finish the work. The plant included bins for charging the mixer, which were loaded by a clamshell derrick. The 40-ft. roadway was concreted first, leaving the sidewalk steel open. Upon this on either side of the roadway was laid 2-ft. gage industrial track on which 1-yd. Koppel cars were operated. These lines of track were connected just beyond the concrete tower by a 180-deg. curve and were connected at the point of concreting by a trussed bridge spanning the roadway.

Each end of this bridge rolled on two wheels traveling on the I-beam at the curb. The space between this point and the industrial track resting on the sidewalk framing was bridged at either end by a pair of rails, resting on the main bridge and on the inner edge of a turntable, as shown in the photograph. These turntables and the track sections on either of them resemble the track equipment used by street-railway companies in putting in a temporary turnout. The entire arrangement rested on top of the rails of the industrial track, and the concrete cars rode up on it wherever it might be placed along the track. With this arrangement it was a simple matter to roll the bridge along as the concreting progressed. The turntables were kept even with it by being barred along the top of the industrial track.



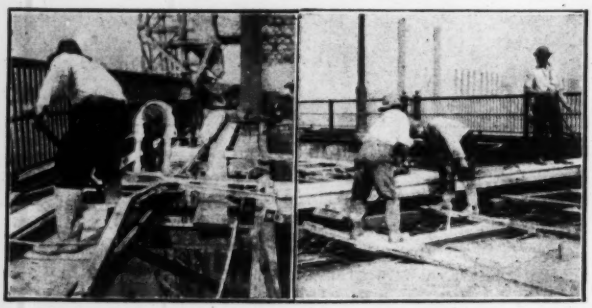
TRAVELING PLATFORMS OVERCOME DIFFICULTY OF PASSING DEEP FLOOR-BEAMS

In this way, with a low labor cost for maintaining and shifting the track, practically every batch of concrete was dumped directly in place.

Swinging Staging Used for Formwork

A double row of wooden ties, beveled on the sides and ends, were laid small face down and spaced with 15-in. plank to form pockets and grooves in which the ties and rails of the street-railway tracks will be placed. These ties were kept well oiled and had an eye-bolt at each end for removing them from the concrete after it had set. However, forms of the same shape made from 1-in. plank covered with sheet iron were substituted before the contract was finished and were found to work much better.

As the viaduct was at a considerable height from the ground, the matter of staging for the workmen wrecking the forms under the roadway and sidewalks presented quite a problem. Some form of staging swung from the steelwork at once suggested itself; but because of the peculiar construction of the floor system, with the stringers resting on top of the floor-beams, such staging was difficult to arrange so that it could be moved along readily. This was finally managed successfully by suspending a traveling platform from four sets of hangers. These hangers, passing through 6 x 8-in. timbers, parallel to the bridge, on which the staging was laid, were fastened at their upper ends to small wheeled trucks rolling on the lower flanges of the stringers. The floor of the platform was about a foot below the bottom of the floorbeams. When the platform traveled up to a



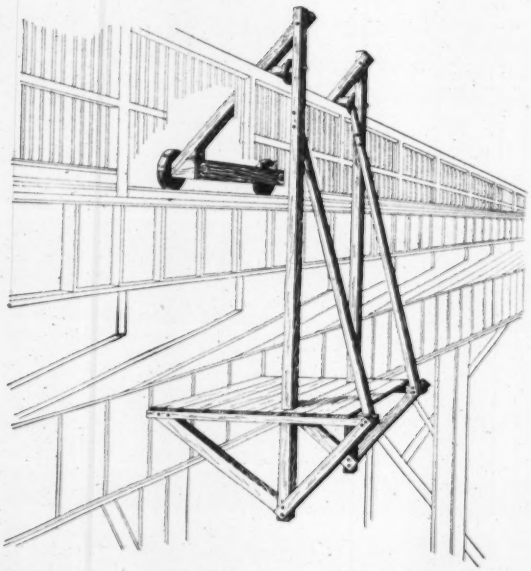
BRIDGE ROLLED ON RAIL-GROOVE PLANK AND CURB BEAMS

floorbeam, the front set of hangers was taken down, the platform shoved ahead and the front hangers replaced on the far side of the floorbeam. The next row of hangers was then taken out, the platform moved ahead and the hangers replaced in the same way, and so on until the platform had moved past the floorbeam.

Pass Form Slabs Through Hole in Tie Pocket

The platform itself, about 25 ft. square, consisted of 2-in. planking supported on the 6 x 8's mentioned, one of which was placed directly beneath each of the six lines of the stringers. This construction left a 5-ft. open space on each side between the girders that carried the floorbeams and the edge of the platform, so that the workmen could get on it from the under side. As the forms were not removed till the concrete was seven days old, openings in the slab were provided through which to pass the sections by leaving a 7 x 14-in. hole in the bottom of a tie pocket in every other panel.

Two panels of forms are removed at a time, stacked on the platform till the traveler reaches the opening, passed through and carried ahead to be reërected. With this platform about 800 lin.ft. of formwork was provided, which was enough to keep well ahead of the con-



SIDEWALK FORM PLATFORM HUNG OVER RAIL

crete. The forms themselves were flat slabs of 2-in. plank about 4 ft. 9 in. wide, fitting between the stringers. They were supported by small struts and blocks from the lower flanges of the stringers. The blocks, at the bottom, were held apart by pipe spreaders. The forms were concreted in sections about 75 ft. long, containing 80 yd., a 1-yd. mixer being used.

Portable Mixer for Sidewalks

A one-bag batch portable gasoline-driven mixer, operated on the deck of the roadway and supplied with materials by motor truck, is being used in laying the concrete sidewalks. The forms for these sidewalks are erected from the roadway and taken down from travelers, which are cantilevered out over the bridge railing. These travelers roll on the finished sidewalk, and the way in which the platforms are suspended from them is shown in the sketch.

The bridge is being completed for the City of Cleveland under the direction of Frederick D. Richards, bridge engineer, and A. B. Cook, constructing engineer, of the Department of Public Service.

San Diego's Water-Supply Guarded

Owing to the unsettled state of affairs since the declaration of war and realizing the seriousness of disaster to the water system of San Diego, Calif., F. M. Lockwood, manager of the Operating Department, has deemed it necessary to provide guards. An average of twenty men daily have been stationed at various points in the system. The expense of this protection, according to Mr. Lockwood, is $2000 per month.

Graduate Conferences with Leading Engineers Successful

Plan at Yale of Having Men in Practice Talk Over Methods with Small Classes Helps Men, Students and School

SUCCESS has attended the conference courses for graduate civil-engineering students held during the past year at Sheffield Scientific School, according to the report of J. C. Tracy, professor of civil engineering, to the director of the school.

The plan, outlined in the 1915-16 report of the president of Yale University, was to bring together the graduate students of civil engineering for a series of five to eight conferences with a member of the faculty of the school and a successful engineer practicing in each branch of civil engineering, these engineers being appointed by the Yale Corporation. The distinctive feature of the plan is the conducting of each course as an open series of discussions, not as a lecture course. The topics discussed at these conferences were of course carefully outlined in advance by the professor and the specialist conducting each course. The essential engineering principles brought out at each conference were subsequently discussed in the classroom and applied to practical problems.

The course for the highway engineers was conducted by Professor Farnham and C. J. Bennett, state highway commissioner of Connecticut, while that in sanitary engineering was planned and carried out by Professor Barney, Allen Hazen and George W. Fuller, the last two being consulting engineers in New York City. Courses in railway engineering, by Professor Barney and F. Lavis, of New York; in structural engineering, by Professor Bishop and O. E. Hovey, assistant chief engineer of the American Bridge Co.; in masonry and concrete, by Suttie and James B. French, of New York City. A course in general engineering, in which Nicholas S. Hill, Mansfield Merriman, Clarence Blakeslee and others conducted conferences, was also held. In addition to the specialist who helped to plan each course, other prominent engineers, many of them graduates of the school, held individual conferences on phases of each subject with which they were especially familiar.

Graduate Students May Not Specialize

As the 12 graduate students who took this course were not permitted to specialize, the broad general training thus acquired is thought to have given them a thorough grounding in the principles that govern the solution of problems met in actual practice, and especially in the economic considerations that enter into engineering work.

It is believed that the conference courses benefit the faculty as well as the students through contact with the leading engineers, including alumni who contribute their services. The conferences bring out the best and most recent examples of engineering practice in design, give the much needed emphasis to the practical economic considerations involved, and increase the confidence of the students in the instruction of the regular faculty by showing them that successful engineers practice the very things that have been urged as of first importance in the classroom. Much good has also resulted to the school from the closer contact into which its graduates, the other engineers interested in the course, and the faculty have been drawn.

LETTERS TO THE EDITOR

Comment on Matters of Interest to Engineers and Contractors Will Be Welcome

Deposits in Tidal-Water Sewers

Sir—The notes on "Tidal-Water Sewer Outlets," by A. G. Dalzell, engineer of sewers, Vancouver, B. C., printed in *Engineering News-Record* of June 1, p. 516, mention the collection of grease that occurs on the arch of sewers periodically flooded by the tide. Similar deposits were observed by me in inspections made in 1910 for the Metropolitan Sewerage Commission of New York City in the tide-locked sewers of Manhattan and mentioned in the report of the commission of that year. In the Jefferson St. sewer it measured a foot in thickness at one point and for about 600 ft. from the outlet averaged about 6 inches.

The material constituted a regular growth, apparently starting from numerous foci and coalescing, and was covered with a tenacious coat of mycelium which

GREASE AND ORGANIC GROWTHS PARTLY FILLED THIS NEW YORK SEWER

prevented erosion. A sample that I had on my desk showed a rather granular structure, whitish in color, but containing black specks—possibly of coal—and numerous small worms. The odor was moldy, but not offensive, probably due to the activity of the contained organisms. A sample examined by Dr. Payne B. Parsons under the microscope showed "large numbers of protozoa, chiefly the paramecium, large numbers of mold hyphæ and yeast cells, wood and other fibers, threads of wool and cotton, hair, feather barbs, seeds of wheat and oats, paper, glumes, striated muscle tissue, etc." From the surface "rootlike processes of (the) leptomitus extended deep down into the substance of the deposit." The bulk of the material, however, was compposed of insoluble soaps and fats, and a bacteriological examination showed 42.5 million bac-

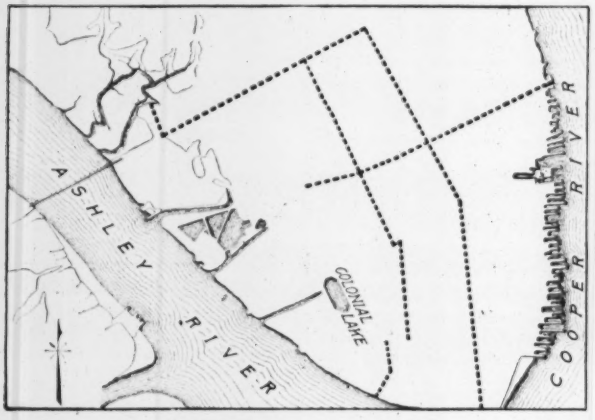
teria and 2 million molds per gram. The weight was reduced 70% by drying.

Suspended from the above deposits were the delicate lace-like pendants of mold which Mr. Dalzell has found in such abundance in the Vancouver sewers.

The result of such growths is of course a material reduction in the capacity of the sewer, so that in extreme cases their removal would appear to be worth the cost. In Manhattan their occurrence was not general, but it is conceivable that, with the increasing demand for grease due to the war, the recovery of grease might offset the cost of removal where it has attained a thickness of several inches in a large sewer.

The prevention and handling of sludge deposits in these low flat sewers is, as Mr. Dalzell says, "difficult and unpleasant work, the difficulty being greater in old sewers because no provision has been made for the entry of suitable apparatus."

An interesting example of some old sewers where such troubles have been experienced is found in Charleston, S. C., where several years ago I happened to ob-



THESE TIDAL DRAINS AT CHARLESTON, S. C., ARE CLEANED EVERY TWO YEARS

serve the operation of sludge removal from a sewer that was said to be without any slope. According to a recent letter from J. H. Dingle, city engineer, a system of "tidal drains," shown in the accompanying drawing, were built about the year 1856, running across the city between the Ashley and the Cooper Rivers. These drains were in cross-section 3 ft. square, surmounted by a semicircular arch, with the floor uniformly 1.8 ft. above mean low water. The tidal range is 5 ft., so that these sewers are surcharged at every high tide. It was believed, when the sewers were built, that by opening tide gates, placed at the outlets, at low tide the deposits would be flushed out, but this was not found to be the case, so that a general cleaning is necessary every two years.

This is accomplished by drawing two small platform cars toward one manhole from the next manhole on each side. Each car is loaded by two men who follow it through the sewer. On reaching the central manhole each car is hoisted out and dumped.

In cities of such low, flat topography as Charleston the choice is necessarily one between pumping the sewage and the removal of deposits.

KENNETH ALLEN,
New York City. Engineer of Sewage Disposal.

Track Material for American Engineers

Sir—The excellent suggestions contained in G. P. DeWolf's letter, in the June 21 issue of *Engineering News-Record*, p. 613, call attention to methods by which many serious delays may be avoided in the emergency trackwork which our men will doubtless be called on to perform in the rear of the European battlefields. The points brought out are so valuable that a further discussion might be of interest.

It occurs to the writer that a consideration of some of the difficulties encountered by railway men in the United States might indicate troubles that may be expected in the foreign service. For instance, how many delays have been occasioned by the breaking prematurely of packages of bolts and spikes, by the difficulty in transporting 200-lb. kegs of these necessary articles by hand over broken ground, by failure properly to match up angle bars which are manufactured for use in pairs, and from many other avoidable causes?

The following departure from ordinary American practice is suggested as making for a saving in confusion and delays:

If splice bars are manufactured to be used in pairs, each pair should be well fastened together by soft wire.

Bolts and nuts should be put up in uniform packages of 100 lb. each, so that they may be handled and carried for reasonable distances by one ordinary laborer. All nuts should be run well up on the bolt, so that the number of loose nuts in each package may be reduced to a minimum. All packages should be sufficiently substantial to insure against breakage in transit and reshipment. Such materials will doubtless be rehandled from five to twenty times, but the reduction in weight per package should reduce the number of breakages as well as facilitate the handling at the point of use.

Track spikes should also be put up in smaller packages (of a distinctive type).

The advantage of proper packing is appreciated by every engineer who has had an opportunity of comparing shipments made by American and European manufacturers to foreign points. It is the rule rather than the exception that American goods reach their distination in wrecked and dilapidated crates and containers, and one is fortunate if the shipment is usable after it arrives.

In considering conditions that may govern railroad repairs and construction in Europe, the engineer who is unacquainted with such work in connection with the operation of an army might well compare it with one long combination of problems that are met in our local work in connection with wrecks and washouts. There should not be the confusion that one occasionally sees at a railroad wreck, but there will be emergencies, the necessity of doing with what you can get rather than with what you would like, and the most urgent need for speed. There should be no lack of labor; but unless the greatest care and foresight are exercised, there may often be delays through lack of, and improper assortments of, material.

The same principles of standardization suggested by Mr. DeWolf in regard to track materials should also be applied to bridge material, and, so far as possible, to rolling stock. Fortunately for the present emergency, most European railways are constructed to the same

standard gage used in the United States, although every man who expects service in countries using the metric system should familiarize himself with that system to such an extent that he may use it readily. In order that the engineer's fund of experience gained in this country may be quickly available at all times, he should be able to translate readily from the metric to English standards; for while he will learn to figure the metric system with almost no effort, he will still think in his old standards, and without the ability to translate quickly he will be led into errors of judgment. It will take the average man longer to learn really to think in terms of a new system of measurement than to learn to speak a new language. ARTHUR M. SHAW,
New Orleans. Consulting Engineer.

Develop Niagara by International Agreement

Sir—I see that the Hon. H. R. Flood, chairman of the Foreign Relations Committee of the House of Representatives, has introduced a resolution to permit taking 20,000 cu.ft. of water per second from above the Niagara Falls (as an experiment until July 1, 1918) for power development. There are also several concerns which desire to divert water from above the falls and others from above the rapids below the falls. In each case the concern would return the water to the Niagara River below the lower rapids, in order to take advantage of the 300-ft. head.

This will not only destroy the beauty of the present falls and the rapids below, but will create a very dangerous condition indeed, for to carry out these plans will be equivalent to committing suicide.

The reason for this effect must be plain to anyone who knows the Niagara River well—for rapids always mean shallow water—and the Niagara rapids, as all others, are formed by rocks projecting above or near the surface, as can easily be seen from the shore. The rapidly flowing water striking these rocks is hurled up into the air, forming the magnificent spectacle we know so well. There are so many of these rocks that the flow of the river (220,000 cu.ft. per sec.) is only barely sufficient to carry away the ice, of which an enormous amount passes over the falls every spring.

The various projects want to divert 50% or more of the flow from the rapids through new channels (canals and tunnels); and if they are allowed to do this, then the remainder of the water flowing through the Gorge (in which the rapids are) will not be enough to carry off the ice, which will at once cause an ice jam.

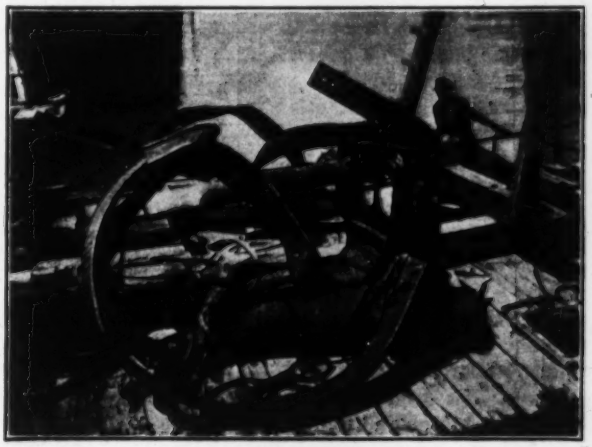
This ice bridge or jam is liable to be a hundred feet or more in height and will result in the destruction of all the existing power plants at the falls; for when the jam breaks, all the new power plants below the ice jam will be carried away. All power development in the Niagara River would cease for a year or two. This can easily be understood by those who saw the jam, a few years ago, which lasted for eight hours and, in breaking, stripped the banks to a height of 20 to 40 ft. for miles down—destroying wharves, etc., at Queenston and Lewiston.

The Niagara River should be developed to give the maximum amount of power at minimum cost and at the same time to preserve the beauty of the falls. This result can only be obtained by an international agreement in which the entire question should be treated as a unit—not as a "crazy quilt" patchwork. Otherwise, the consumer pays the bill. T. KENNARD THOMSON,
New York City. Consulting Engineer.

Dredge Cutter Twists Steel Piling

Sir—The accompanying photograph showing twisted steel piling has been sent to us by the Lord Young Engineering Co., which is operating one of our suction dredges in Honolulu.

The piling was twisted by the cutter on the suction dredge. This cutter and ladder were made exceptionally strong for handling live coral in that neighborhood, but we had no idea it would play such havoc with the steel piling. The dredge is electrically operated, and the motor driving the cutter is mounted on the ladder and swings with it, thus eliminating the necessity for universal couplings, which is necessary when the motor is placed on the deck of the dredge.



STEEL PILING TWISTED BY DREDGE CUTTER

GEORGE L. HURST,
Manager, Dredging Department,
San Francisco. Union Iron Works Co.

Minnesota Water-Filtration Plants

Sir—In the tabulation entitled "Water-Filtration Plants in the United States and Canada in 1917," published in *Engineering News-Record* for May 24, 1917, p. 408, Minnesota is included as one of the states. We keep a very exact record in this office of the water-purification plants now operating in Minnesota, and our record is somewhat at variance with that given in the table.

Our records show six municipal and one privately-owned filtration plants supplying a total population of 326,306 and having a capacity of 66,000,000 gal. a day. Of these totals, the Minneapolis plant supplies a population of 301,408 and has a capacity of 60,000,000 gal. The other six places are Breckenridge, Chisholm, Crookston, East Grand Forks, Ely and Gilbert.

Minneapolis, Minn. H. A. WHITTAKER,
Director Minnesota State Board of Health.

ENGINEERING LITERATURE

A REVIEW OF BOOKS AND A LISTING OF NEW PUBLICATIONS

Writing a Technical Report

Analysis of Successful Reports Points the Way—Keeps Reader in Mind—Elements of Report—The Appendix

By William Green
Teacher of Report Writing, Massachusetts Institute of Technology

THE man who must write a technical report is often at a loss. Even though he is sure that through his past experience and recent investigation he is fitted to treat some phase of a subject, he feels that because he is not a practiced writer he cannot successfully convey his information.

He therefore seeks to write by the method to be acquired most quickly; and since he knows of good technical reports which have been produced by others who, like him, must have had small opportunity to practice writing, he very often decides that there must be a trick to report writing. Almost everyone who has to write reports goes through the state of being sure that somewhere there is a device which can be used like a general formula, in which one has only to substitute particular values. Search reveals no such device. It is a fact, however, that good reports are being written by those who have obtained all their practice from writing business letters, and an analysis should bring out methods by which others who have like equipment can produce successful technical reports.

Consider the Reader

The purpose of this discussion is to show that *the selection of material, its arrangement and the manner in which it is presented are determined through consideration of the reader and his peculiar need of information regarding a definite subject.* It is only thus that a report can be made both adequate and concise.

A technical report differs from other forms of exposition in that invariably it is not the writer, but the reader, who has suggested the subject. Before the maker of a technical report begins his writing, the reader has asked for information on definite phases of a definite subject; he may have suggested the scope of the investigation, and he has indicated to what degree he wishes the writer to make recommendations. The writer has been asked a definite question; his reply is a technical report.

The technical report must always contain the following material, usually in the arrangement here given. It must be noted that in many reports parts shown as coordinate in the outline are very different in the space required for their treatment.

A. The report proper: (1) The question—(a) occasion for the report; (b) scope of the report. (2) Methods used in the investigation. (3) The reply to the question.

B. The appendix.

The report proper must stand as a unit. While it is a reply to one who has asked a definite question, it must be so written that the report will be useful not only at the time it is received by him, but also at any future time when the related phases of the question are not so clearly in mind. Moreover, while its chief end is to furnish information to someone whose interest has caused him to ask for it, it must not fail to give the information in such a way that it can be used by others. To accomplish these ends, the writer must record the question (1). To do this, he should show the occasion for the report (a). Here there must be a pointed reference to the order and, if any exist, to the formal appropriation that led to the undertaking of the report, and to all subsequent related orders and memoranda. Then there should appear a statement of the scope of the report (b). This must be an exact definition of the subject treated. The exact statement of this subject can usually best be accomplished by quotations from the request for the report. Often the field to be covered can be made more clear by pointing out closely related phases of the subject that have been purposely left out of the discussion. A statement of the methods used in the investigation (2) is important, for newly discovered information may at any time affect the value of the conclusion reached in a given report. It is therefore of the utmost importance that the author should state explicitly what methods he used.

After the brief introduction described above, the report proper takes up the reply to the question (3). This is the main body of the report.

Keep the Reader in Mind

The peculiar needs of the reader determine for the writer what topics he should include in his report and what he should omit. Even if the writer has exactly the information his reader requires and has no misapprehension as to the subject he is expected to cover, his report can be effective only in so far as he knows his reader and keeps in mind his needs. Unless the reader is known to the writer, the latter may fail to be adequate by excluding necessary information; or he may fail to be concise by giving information that is not needed, as when definitions are supplied to one who is familiar with technical terms. Even when he knows his reader's needs, the writer may neglect to keep them clearly in mind. Often when a layman has asked an expert for information, the specialist's enthusiasm leads him into writing a report that could be useful only to another specialist. A report is written not only on a definite phase of a subject, but also to a definite person. No report can be effective where the reader's needs do not govern the selection of the subject matter.

Moreover, the style of the report is controlled by the writer's relation to the reader. To carry its message most quickly and forcefully, the report must be concise. Sometimes a report should take the form of a flat state-

ment. Amplification and substantiation must be included in such a report; but they are placed there, not so much for the reader's attention, as because there they may be most conveniently kept as a matter of record. On the other hand, a method of presentation so concise should be used only when the recognized authority of the writer is unquestioned, and even then, only when a full understanding of the reasoning would require on the reader's part more study than is warranted by his interest. In all other cases the man who wishes to write an adequate report must tell the whole story, and he must tell it in a way that can be fully understood by him to whom the writer is reporting. Yet here again the reader's knowledge of technical expressions and symbols determines how concise the report may be. When technical terms are mutually understood, definitions are tedious; and when there is no doubt that a plotted curve will convey information—that it can be "read"—pages of exposition may often be eliminated. Through careful study of the reader it is possible to adopt for each report a suitable style.

Function of Appendix

Granting that a division of the material to be presented in the report proper and the appendix is wise, we must assure ourselves that each is so written that it fulfills its part. In the report proper we must be as direct and as concise as will be allowed by the reader's ability to follow our treatment. Since we have the appendix, we may by conveniently placed references to it refer the reader to any explanations or substantiations. In the reply to the question the reader can thus be given a direct route. If his inability to understand, or his unwillingness to accept a statement without supporting data requires a deviation, he of his own volition turns aside from the direct path. No other thing so tends to make a report effective and useful as a reply to the question which logically and as briefly as may be leads the reader straight through to the answer of his question.

But the report must be a complete discussion of the phase of the subject it is treating. Therefore, it must substantiate its thesis, and there must be no doubt that all of its statements are understood. Material necessary to fulfill these conditions is placed in the appendix. There should appear in the appendix all important original data gathered for the report. Any general information that in the opinion of the writer may be inaccessible and needful to the reader should be given fully, and there should appear exact information as to where subjects like that of the report, or related phases of the subject, may be consulted.

Reviews and Notes

Handy Volume on Trench Warfare

TRENCH WARFARE: A Manual for Officers and Men—By J. S. Smith, Second Lieutenant with the British Expeditionary Force. New York: E. P. Dutton & Co. Cloth; 4 x 6 in.; pp. 144; illustrated. $1.50 net.

Lieutenant Smith has prepared a handy volume which will greatly interest the 50,000 odd officers of the new American army units. The contents of the book will be no novelty to them by the time they are assigned to troops, for the trench-work instruction given and to be given covers a somewhat broader field in greater detail and thoroughness. But the book will be of great assistance as the nucleus of each new officer's notes on training camp lectures, demonstrations and practice. Engineer officers particularly can profit by Lieutenant Smith's book for naturally it relates more to the construction, maintenance and equipment of trenches and trench accessories than to their tactical and strategic employment.

Trench siting is the first topic and here the practice disclosed is at variance with the common American idea that protective works should not follow hedges, tree rows, etc. The excuse is that the development of artillery fire has made ranging by trial shots so easy that prominent marks are not needed, while the natural growths may protect working parties and hinder aërial reconnaissance.

Construction features are next described—traverses, revetments, dugouts, latrines, dumps. The highly important subject of obstacles and entanglements is dismissed with a few pages—which will be regretted in view of the author's chances for observation and the attention being given to it by American engineer officers. The construction of several hand bombs is described and the organization of bombing parties—"mopping up" squads—but the author offers little on rifle grenades.

Gas warfare has an important place in the book. Particularly interesting are the directions for counteracting effects of gas and preventing asphyxiation when the men have no gas masks. Toward the end of the book are miscellaneous notes on the duties of men and officers in trench warfare.

The casual reader might infer from the author's introduction, describing the creation of a trench line from Switzerland to the sea, that something radically new had been done in connecting rifle pits, but the works all differ little from those described for years in army engineer manuals.

From a British Viewpoint

Reviewed by R. Fleming
American Bridge Co., New York City

THE CALCULATIONS FOR STEEL-FRAME STRUCTURES. Designed to Comply with the Requirements of the London County Council (General Powers) Act, 1909, with Notes on the Application of Theory to Practical Design—By Walter Cyril Cocking, M.C.I., M. J. Inst. E., Reinforced Concrete and Structural Engineer; Lecturer in Drawing and Design of Structural Steelwork at the London County Council School of Building. New York: D. Van. Nostrand Co. London: Scott Greenwood & Son. [The Broadway Series of Engineering Handbooks.] Cloth; 5 x 8 in.; pp. 312; 78 illustrations; 6 folding plates. $2.25 net.

The text of this book is written from a British viewpoint and is intended to comply with the London Building Code, the structural-steel requirements of which are reprinted in the beginning of the book. Fifty pages at the close set forth in detail the calculations for the steel frame of a five-story London warehouse. The intervening pages treat of the usual subjects—bending moments, shearing stresses, beams, columns—which necessarily enter into a work of this kind.

The numbering of the various formulas by giving each the number of the page on which it first occurs,

with a distinctive letter, is a unique feature and especially convenient for reference. The numerical examples throughout the book are numbered consecutively. A tabulation in alphabetical order of the symbols used would have been a further help to the reader.

The author states that the book is written to meet the needs of structural draftsmen and others who do not possess a knowledge of higher mathematics and the calculus. Algebra and trigonometry is the extent of mathematical knowledge presupposed.

It is against the implication that a knowledge of the calculus is not really needed by a designer of steel structures that the reviewer wishes to protest. Why do so many engineers and draftsmen fear the calculus as children fear the dark? Nine-tenths of the problems involving the calculus that the structural engineer is likely to meet can be solved by formulas derived from the successive differentiation and integration of X^n. Mr. Cocking's methods of obtaining deflections and shearing stresses are ingenious, but a knowledge of the calculus is necessary to a general treatment of the subject; and an engineer who can use it will not be satisfied with the limited range of special cases. As Goodman truly says in "Mechanics Applied to Engineering": "Not one engineer in a thousand ever requires to make use of any mathematics beyond an elementary knowledge of the calculus, but anyone who wishes to get beyond the kindergarten stage of the principles that underlie engineering work must have an elementary knowledge. The labor spent in acquiring sufficient knowledge of the calculus to enable him to solve practically all the problems he is likely to come across, can be acquired in a fraction of the time that he would have to spend in dodging it by some roundabout process."

In the chapter on "Stresses in Lattice-Frame Structures," the author uses Ritter's method of sections to determine stresses in roof trusses. He thinks this preferable to the graphical method. The reviewer differs. The stresses in the example given can be found in much less time by drawing stress diagrams in accordance with the teaching of any American textbook. Moreover, the closing of the stress diagram is a check not obtained by analytical methods.

The reviewer has no wish to minimize the many excellent features of the book, but he thinks that an engineer or draftsman with only a mastery of the book and the little knowledge it presupposes is not sufficiently equipped to design steel-frame structures other than those of the simplest kind.

Electrical Testing

ELECTRICAL MEASUREMENTS IN PRACTICE—By F. Malcolm Farmer, Chief Engineer, Electrical Testing Laboratories. New York: McGraw-Hill Book Co. Cloth; 6 x 9 in.; pp. 359. $4.

The particular audience addressed by Mr. Farmer is of course largely composed of electrical engineers. But his book is of considerable use in the libraries of a larger group of engineers, particularly those dealing with hydro-electric work, because ultimately the performance of their generating and transmission installations have to be tested by well-tried instruments and practices of the electrical test laboratory, more or less modified to suit field conditions. The author is the head of one of the best-known commercial testing staffs in the country, and throughout the book the topics are presented from the practical standpoint of the tester. Descriptions of instruments and methods of employment alternate. The sections on power and energy measurements and on maximum-demand and curve-drawing instruments are of conspicuous merit.

Valuation of Railways

Reviewed by M. P. PARET
St. Charles, La.; Late Valuation Engineer, Interstate Commerce Commission

RAILWAY ESTIMATES, DESIGN, QUANTITIES AND COSTS—By F. Lavis, M. Am. Soc. C. E., Special Lecturer Railway Engineering, Yale University. First edition. New York: McGraw-Hill Book Co. Cloth; 6 x 9 in.; pp. 608; 99 illustrations and folding plates. $5.

The author states in his preface that the purpose or object of his book is the presentation, for the use of engineers, of data serviceable for estimating the value or cost of proposed or existing railroads. The book is more than a development of Chapter 8 of the author's "Railway Location, Surveys and Estimates." It is an expansion of that chapter and a setting forth of the timely subject matter in a manner that carries weight and impresses the reader with the author's broad and practical knowledge of the subject. The book contains some new things and presents others in a new and practical way.

Very wisely, the author frequently cautions the reader against misdirected use or application of data, figures or deductions. To use such data as support for an estimate of a certain line of railroad calls for a personal knowledge of conditions on the lines from which figures are quoted or used as support.

Why did not the author expand the little he says about land or right-of-way into a chapter? The requirements in this day and country for almost any line of railroad in the way of land or right-of-way, station grounds, terminals, etc., run into much more money than do many of the other elements of cost, relating to which considerable space is given.

In Chapter 1, "Preliminary Estimates Previous to Surveys," the statement is made that it is possible for an experienced engineer or contractor to ride over a proposed route and estimate within about 10% the cost of grading and bridging. This seems much too general a statement to be made or accepted without qualification. What is meant by riding over a proposed route? A proposed route when ridden over is liable to be at many points far from where a survey may place it. The reviewer is of the opinion that to estimate the cost of grading and bridgework within 10% by riding over a line in advance of surveys, such a line must be in very easy country and that the riding over must embrace quite a complete reconnoissance which would develop controlling features, or be in a country adjacent to other highways that would indicate the nature and extent of classification, drainage openings, etc.

A variation of 10% between the estimated cost of such work after survey and the determined cost of actual construction would not ruin the reputation of an experienced engineer, but luck would figure as largely as experience if the guess came within 10% of actuality.

Under "Contingencies" the author recommends that an allowance of 15% be added to grading and bridging

when estimates are made previous to construction, presumably after the information derived from detailed surveys is available. How much should be added for contingencies to an estimate made after a ride over the route?

It is a pleasure to note that the author, in handling Chapters 3 to 11 inclusive—the principal classified cost elements—has, as is his custom, confined himself to the practical illustrative essentials and avoided wordy expansions of irrelevant features.

One would have been glad to find in the text three or four chapters instead of three or four pages on the subject of electrical operation and electrification of steam roads.

Consistent use of this book cannot fail to be of service and support to any railroad engineer.

Treatise on Water Purification

Reviewed by ROBERT SPURR WESTON

Consulting Engineer, Boston, Mass.

WATER PURIFICATION—By Joseph W. Ellms, Member American Society of Civil Engineers, American Chemical Society, American Public Health Association and New England Water-Works Association. New York and London: McGraw-Hill Book Co. Cloth; 6 x 9 in.; pp. 485; 150 illustrations. $5 net.

The author's 25 years' experience, beginning in the laboratory of the Massachusetts State Board of Health and extending through many years at the Louisville and Cincinnati water-works and elsewhere, has qualified him for his well-performed task of writing a treatise on water purification.

The book begins very logically with water in its relation to public health and comfort. Next, the various means of purification are discussed, and progress in filter construction—particularly, rapid sand filters—is described. The methods of storing and applying chemicals are treated, and there is a chapter on power-plant and miscellaneous equipment. The work also contains chapters relating to the cost of construction and operation of rapid sand filters and on the technic of filtration, including rates, loss of head, washing, coagulation and disinfection. Two chapters are devoted to the removal of dissolved mineral matter and one to the control of water-purification processes. The appendix contains two articles by C. N. Miller, in one of which the flow of water through rapid sand filters is discussed mathematically, and in the other there is given a formula for computing the discharging capacity of filter wash-water troughs. In the appendix are 12 tables useful to operators of water-purification plants.

As a whole, the book impresses one with its sincerity of purpose and reliability of data. It will be of invaluable assistance to the designer and operator of water-purification plants. A large part of the work is the result of the author's own experience. The remainder consists of quotations from published articles, for which there are references, mostly American, at the end of each chapter. Much of the material is new, and the illustrations are modern. The reviewer, however, finds no mention of the hydraulic method for restoring sand to slow filters, in use at Washington and Pittsburgh, where the method of spreading by hand has been abandoned.

Particularly valuable are the data relating to the details of rapid sand filters, in the development of which Mr. Ellms has played an important part. It is hoped, however, that in future editions the double-bottom type of filter represented by the Erie, Penn., plant will be described and illustrated, and that an illustration of the Wheeler filter bottom will be taken from practice.

Engineers will find of great use the descriptions of purification plants—particularly those of the details, such as controllers, gages, meters, hydraulic valves, automatic scales, chemical feeders, auxiliary machinery, etc. The use of the book would be greatly facilitated if the index were amplified.

Blast-Furnace Design and Construction

Reviewed by CHARLES E. LEHR

Chief Engineer, Bethlehem Steel Co., South Bethlehem, Penn.

BLAST-FURNACE CONSTRUCTION IN AMERICA—By J. E. Johnson, Jr. New York: McGraw-Hill Book Co. Cloth; 6 x 9 in.; pp. xi + 415; 247 illustrations. $4.

Engineers and furnace men engaged in building and rebuilding blast furnaces will be benefited by reading Mr. Johnson's book. It treats the construction of plant and equipment, from the handling of raw materials to the finished product.

A broad and comprehensive knowledge of construction methods and design and of what has proved best in practice is displayed by the author, who, unlike a great many writers, does not hesitate to state what in his opinion is the best method or equipment for the work required to be done. The chapter on distribution of stock in the furnace proper is well worth the price of the book, as probably more troubles in blast-furnace operation are traceable to poor distribution than to all others combined.

The chapter on washing and cleaning gas could well have been enlarged in scope, so as to present the best types of such equipment in more detail as a guide to point the way for designers and operating men, as this phase of blast-furnace operation is not generally given the importance is deserves. This statement applies with equal force to the chapter on boiler plant, with particular reference to burners for blast-furnace gas. It should be gratifying to the busy man that practically all historical and obsolete methods and equipment for the production of iron have been left out of the book, and the reader is introduced, by successive steps, to recent practice in use at the larger and more modern plants.

In general, the book is a valuable contribution to the literature of the subject and bespeaks no little study and investigation by the author. The intention to amplify this work by another on blast-furnace operation will be awaited with interest by the producers of pig iron and allied products.

English View of Depreciation

DEPRECIATION AND WASTING ASSETS: And Their Treatment in Computing Annual Profit and Loss—By P. D. Leake, Fellow of the Institute of Chartered Accountants in England and Wales. London: Sir Isaac Pitman & Sons, Ltd. New York: Isaac Pitman & Sons. Cloth; 6 x 9 in.; pp. 233; folding and other tables. $4.

While there is still, unfortunately, plenty for us in America to learn about depreciation and kindred subjects we have been plunged so deeply into the subject of valuation, such definite schools of reasoning have been established, and the legal aspects have so much bearing, that it seems hardly possible that we can look

to England or any other foreign country for light. The volume in question deals mainly with industrial plants and the wastage of sale value. There is discussion of the various well-known methods of accounting for depreciation, but the subject is set forth as clearly in American books, in which the examples are in terms of dollars and not of the confusing English pounds. American industrial engineers and accountants might derive some useful ideas from the book, but valuation engineers in general will get little help from it.

Power Plants and Refrigeration

Reviewed by D. D. KIMBALL
Of Richard D. Kimball Co., New York City

MECHANICAL EQUIPMENT OF BUILDINGS: A Reference Book for Engineers and Architects.—By Louis A. Harding, M. Am. Soc. M. E., Chief Engineer John W. Cowper & Co., Buffalo, N. Y., and Arthur C. Willard, Assistant Professor of Heating and Ventilation, University of Illinois. Vol. II, Power Plants and Refrigeration. New York: John Wiley & Sons. Flexible binding; 7 x 10 in.; pp. 757; illustrated. $5.

The present, or second, volume of this work admirably supplements the first volume, "Heating and Ventilation," noticed by the reviewer on page 602 of the *Engineering News-Record* for June 21, 1917. The authors intended the book to serve for reference and also for practical use in the designing room. It will fulfill the first purpose much better than the second, being too cumbersome and too theoretical or technical to be of real practical service in the drafting room. As a reference book and a textbook for students it should be most valuable. The free use of manufacturers' data adds much to the usefulness of this volume.

The text covers the subjects of fuels, combustion, boiler construction and equipment, chimneys, draft apparatus, engines, turbines, condensers, piping and other equipment, also refrigeration.

There are several forms of boilers largely used by heating engineers not referred to in this volume or the preceding one. To the student, at least, both volumes would be of greater value if they offered suggestions as to where different forms of the same apparatus—boilers, etc.—might best be used.

Illustrations, tables and charts are generously given in a most interesting and helpful form. Good printing, good paper and a fine flexible binding lend charm to the book. Every engineer and student interested in power-plant work will find this volume a desirable acquisition.

Major Activities of the Modern City

MUNICIPAL FUNCTIONS—By Herman G. James, J. D., Ph. D., Associate Professor of Government, Director of the Bureau of Municipal Research and Reference, University of Texas. New York and London: D. Appleton & Co. [National Municipal League Series.] Cloth; 5 x 8 in.; pp. 380. $2 net.

It is a promising sige of widespread early improvement in the way our cities meet the manifold needs of their citizens to have made available so comprehensive a survey of muncipal activities as is this book and to have it come from a southwestern university. The fact that the volume is designed "for use as a textbook in college classes in municipal government" is another sign of promise.

Among the main topics of the book are public health, city planning, public works, utilities, municipal ownershop and municipal finance. The fundamentals of these and the other municipal services discussed are clearly set forth, ways and means are outlined, and some of the corresponding administrative problems are presented.

In the chapters on health and public works, the author has kept clearer of the usual pitfalls that threaten the professor of government than have some of his predecessors. The paragraphs on water and on sewage treatment contain a number of misconceptions or misstatements that may do no particular harm but might well be corrected in a later edition. Examples are calling the activated-sludge process an "improvement of the septic tank process"; stating that "natural oxidation can meanwhile do a good deal toward purifying the effluent by dilution"; and asserting that broad irrigation "involves no treatment of the sewage, but merely discharging it in a place where it will not be offensive."

These are minor defects in a volume which contains a large amount of correct information on supplying city needs and much sound doctrine on municipal policies and administration presented in convincing and readable form.

A Brief for Municipal Ownership

MUNICIPAL OWNERSHIP: A Brief Survey of the Extent, Rapid Growth and the Success of Municipal Ownership Throughout the World, Presenting the Arguments Against Private Ownership, the Failure of Regulation and the Advantages of Municipal Ownership.—By Carl D. Thompson. New York: B. W. Huebsch. Cloth; 5 x 8 in.; pp. 114; $1 net.

The author has produced a readable brief for municipal ownership—as thoroughly one-sided as a lawyer's brief but more open to attack. Some, if not most, of the statistical and other data are old and some are taken third hand. An instance, possibly one of the worst, may be given. Among the many citations from the late Prof. Frank Parsons' "The City for the People," a book published more than 15 years ago, is one to the effect that the rates charged by privately owned waterworks *are* 43 per cent. higher than those charged by publicly owned works.

Professor Parsons cited as his authority "The Manual of American Water-Works," published in 1890. The author of the present volume is therefore using figures more than a quarter century old. Moreover, he says "the rates charged by private plants taking the United States as a whole, are," etc., from which the uninformed reader would infer that he was being given not only current data but data for all the water-works of the country, whereas Mr. Thompson had before him Professor Parsons' statement that the original figures were published in 1890 and related to "318 public and 430 private water-works."

Massachusetts State Board of Health

STATE SANITATION: A Review of the Work of the Massachusetts State Board of Health—By George Chandler Whipple, Professor of Sanitary Engineering in Harvard University and the Massachusetts Institute of Technology; Member of the Public Health Council, Massachusetts State Department of Health. Vol. 1. Cambridge, Mass.: Harvard University Press. Cloth; 6 x 9 in.; pp. 387; 11 plates and 8 text illustrations. $2.50.

In sketching the history of the Massachusetts State Board of Health for nearly half a century, drawing word pictures of the leading members and officers of the board, and presenting abstracts of the most notable of the board's publications, Professor Whipple is render-

ing a notable service. The pleasurable task he is doing so well is one for which he is well qualified through long acquaintance with members of the board and of its staff and through service on the Massachusetts Public Health Council since 1914.

The present volume, which is the first of three to be devoted to the subject, is in two parts. Part I, first sketches the early history of public health work in Massachusetts to the beginning of the board in 1869. It then outlines the history and the work of the board and its divisions, including the world-famous Lawrence Experiment Station for the study of water purification and sewage treatment and the engineering work of the board. There is also a chapter of biographical sketches; a chapter on the State Department of Health, 1914-16, and one on state sanitation in general.

Part II is an able condensation of the lengthy "Report of the Massachusetts Sanitary Commission of Massachusetts" which under the leadership of Lemuel Shattuck worked out a detailed plan for a "sanitary survey" of the state—really a scheme for state and local health work. This report, published in 1850, recommended that the proposed State Board of Health include in its membership "a civil engineer" and "a chemist or natural philosopher," thus with prophetic vision forecasting the brilliant and efficient work that was to be done in Massachusetts by engineers, chemists and biologists.

A Really Practical Mechanics

Reviewed by J. P. J. WILLIAMS

First Assistant Engineer, Concrete-Steel Engineering Co., New York City

APPLIED MECHANICS—By Alfred P. Poorman, Assistant Professor of Applied Mechanics, Purdue University. New York: McGraw-Hill Book Co. Cloth; 6 x 9 in.; pp. 244; 321 figures in text. $2.

This latest text on the fundamental subject of applied mechanics for engineering students shows the logical improvement in books of this class which would be expected as a result of the marked tendency in recent years toward the commonsense interpretation and exposition of principles in terms of engineering problems. The book is a fine example of effective, interest-arousing presentation through the use of illustrations and problems that should appeal to the student. It is in strong contrast with the older types, in which such problems as those dealing with frictionless beads strung on a wire between the earth and the moon were solemnly presented by the writer or teacher of mechanics. Instead of dealing with abstract principles, the strong psychological appeal of a single engineering problem is used. The statements of principles are concise and clear and are followed by good examples solved with explanations. Each chapter contains a wealth of practical problems, with answers, which should arouse any ambitious student to his keenest efforts. The coördination of algebraic and graphic solutions is another excellent feature of the plan of presentation.

Some of the principles in which many graduates are especially weak have been given exceptionally clear and satisfactory treatment. Computations for centroid and moment of inertia, the discussion of so-called two-force and three-force members, the chapters on friction, combined translation and rotation work and energy, impulse, momentum and impact are all worthy of special praise, particularly as regards the exceptionally well-chosen examples and problems selected for illustration in terms of the future engineering experience of the student.

The typographical work, the drawings and reproductions are also distinctly superior to previous standards. The use of bold-face type for important formulas and of italics to emphasize vital principles should prove a great aid to the student. While practicing engineers would hardly find such a book of direct value unless needed to clear up hazy conceptions, it undoubtedly will be hailed as a most effective tool by teachers of mechanics who are attempting to create clear, permanent and definite conceptions in the minds of their engineering students.

PUBLICATIONS RECEIVED

ORGANIZATION IN ACCIDENT PREVENTION.—By Sydney Whitmore Ashe, B.S., E.E., Chairman, Committee on Safety and Health, National Association of Corporation Schools; Member, Educational Committee, and Secretary of Foundry Section, National Safety Council; Author "Electric Railways," Etc.; Head Educational and Welfare Department, Pittsfield Works of the General Electric Co. New York and London: McGraw-Hill Book Co., Inc. Cloth; 6 x 9 in.; pp. 130; illustrated. $1.50 net.

Based on educational "experiences in organizing safety work." Deals, among other things, with accidents that may be reduced by education; emergency hospitals and first-aid work; accident relationships.

OXYACETYLENE WELDING PRACTICE: A Practical Presentation of the Modern Processes of Welding, Cutting and Lead Burning, with Special Attention to Welding Technique for Steel, Cast Iron, Aluminum, Copper and Brass.—By Robert J. Kehl, Jun. Am. Soc. M. E. Chicago, Ill.: American Technical Society. Cloth; 6 x 8 in.; pp. 102; illustrated. $1.

The subtitle indicates the comprehensive and practical character of the book. The examples are "from the automobile industry, because in that field almost every class of welding is covered."

STRENGTH OF MATERIALS.—By James E. Boyd, Professor of Mechanics, Ohio State University. New York: McGraw-Hill Book Co., Inc. Cloth; 6 x 9 in.; pp. 380; 254 figures in the text. $3.

To this edition the author has added sections on "the method of area moments for deriving equations of the elastic line of beam," on curved beams and hooks, and on theories of failure. In an extended notice of the first edition ("Engineering News," Mar. 14, 1912, page 506), the reviewer commended the book for the use of engineers as well as for the classroom.

BRITISH COLUMBIA HYDROMETRIC SURVEY FOR 1915—Ottawa, Ont.; Dominion Water-Power Branch. Paper; 6 x 9 in.; pp. 446; illustrated.

CLAUDIUS CROZET: His Story of the Four Tunnels in the Blue Ridge Region of Virginia on The Chesapeake and Ohio Railway, Constructed 1849-1858—Compiled by James Poyntz Nelson, Valuation Engineer, Chesapeake and Ohio Railway System. Richmond, Va.: The Author. Paper; 6 x 9 in.; pp. 13; illustrated.

TECHNICAL BOOK WRITING—By J. A. L. Waddell, Consulting Engineer. Reprinted from the Bulletin of the Society for the Promotion of Engineering Education, Vol. 7, No. 3, 1916. Kansas City, Mo.: The Author. Paper; 6 x 9 in.; pp. 48.

TOPOGRAPHICAL DRAWING—By Edwin R. Stuart, Professor of Drawing, United States Military Academy. New York: McGraw-Hill Book Co., Inc. 6 x 9 in.; pp. 119. $2 net.

ROHRNETZBERECHNUNGEN IN DER HEIZ- UND LUFTUNGSTECHNIK—By Dr. techn. Karl Brabbee, Professor in the Berlin Technical High School. Berlin: Julius Springer. Cloth; 8 x 11 in.; pp. 50.

SMOLEY'S PARALLEL TABLES OF SLOPES AND RISES: In Combination with Diagrams of Slopes and Rises and Other Tables—For Bridge and Structural Engineers, Draftsmen, Checkers, Templet Makers, Builders, and Vocational Schools—By Constantine K. Smoley, Author of Parallel Tables of Logarithms and Squares, of the I. C. S. Civil Engineer's Handbook, Etc. New York: McGraw-Hill Book Co., Inc. Leather; 5 x 7 in.; pp. 300; illustrated. $3.50.

NATIONAL FOREIGN TRADE CONVENTION, 1917—New York: The Secretary, India House, Hanover Square. Cloth; 6 x 9 in.; pp. 587.

NEW YORK PUBLIC SERVICE COMMISSION: Report for 1915—Volume 3, Abstracts of Reports of Corporations, Electrical, Gas, Telegraph, Telephone, Steam. Cloth; 9 x 12 in.; pp. 340.

OHIO ENGINEERING SOCIETY: PROCEEDINGS FOR 1917—Norwalk, Ohio: John Laylin, Secretary. Paper: 6 x 9 in.; pp. 146; illustrated.

ROAD AND BRIDGE LAWS OF KANSAS, 1917—Topeka, Kan.: State Highway Commission. Paper; 6 x 9 in.; pp. 45.

THE ENGINEER IN FIELD AND OFFICE

A DEPARTMENT DEVOTED TO DETAILS OF THE DAY'S WORK

Quarrying Marble by Modern Methods

BY E. L. THOMAS
Knoxville, Tenn.

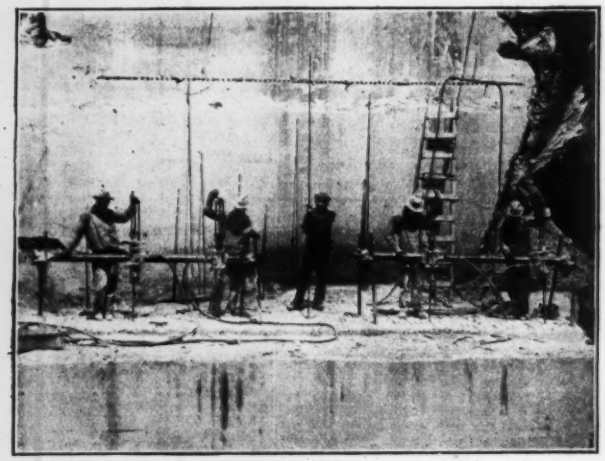
TWO innovations in the practice of marble quarrying—the use of mechanical steel sharpeners and light hammer drills mounted on quarry bars and tripods—have increased the output and lowered the labor cost at two quarries in the Knoxville marble district. The Grey Eagle Marble Co. and the Appalachian Marble Co. produce 4000 to 5000 cu.ft. per month, using Sullivan hammer drills and a channeler.

Sharpening straight or diagonal bits by hand requires 10 to 15 min. per bit, as compared with 4 min. by machine; but the chief advantage of mechanically formed bits is uniformity. When once the correct bit has been determined for a given stone, the shape can be maintained without deviation, resulting in much longer service before resharpening. The sharpener has increased the cutting speed of the channeler by 15%.

With hand hammer and plug drills, ⅞-in. hollow steel is used with hexagon section and 6-point rose bits. The starting gage is 1½ in., with $\frac{1}{16}$-in. drop per 24-in. length. Holes are drilled 14 ft. deep. After heating, one of these bits can be formed in 15 sec., the shank (with collar) in 10 sec., as against 10 min. for bits and 20 min. for shanks when the work is done by hand. The two steel dies form practically a perfect bit, with sharp regular points and ample clearance.

QUARRY BAR WORK WITH HAMMER DRILLS

Light (40-lb.) hammer drills mounted on quarry bars have done 100% better work at the Appalachian quarry than the piston drills they supplanted. The view shows



THIS OUTFIT REPLACES SIX PISTON DRILLS CALLING FOR TWO MEN EACH

a shelf of this quarry, on which are two bars each mounting two drills. The bars are 10 ft. long and carry the cradle, or shell, and feed-screw mounting in which the drills are secured by two hinge-clamps. Horizontal or vertical holes are drilled with equal facility.

The four drills require four runners and one helper, and the outfit replaces six piston drills calling for two men each. The officers of the two quarries furnished this information.

Land Survey Data Made Available for Ready Reference in the Field

BY L. G. HICKS
City Engineer, Rosenburg, Ore.

THE engineer engaged in land surveying is often handicapped in the field by finding that he has not secured enough notes to cover the work to be done or by finding corners described by the notes at hand destroyed, together with the witness trees, and that a starting point some distance away must be sought. Again, the surveyor will often find other bearing trees than those described in the Government records; and unless he has the notes for these trees, they are worthless.

The writer in his practice in southern Oregon has developed a method of keeping all survey notes obtainable according to townships. These are in such shape that when called into the field he has all of the recorded as well as almost all of the private survey notes.

SURVEY MEMORANDA KEPT IN SPECIAL PORTFOLIOS

First copies of complete section notes, giving all topography, are secured for each township in which work is likely to be done. By having the topography, a tedious search for a corner is often done away with, as a reference measurement can be made from some stream or ridge. These section notes are written on specially printed blanks, each 8½ x 11 in. and ruled as shown. After being copied, all sheets are carefully checked.

To describe corners reëstablished or reset, the writer has prepared typewritten blanks, for section, quarter-section and donation-land claim corners. These are filled out whenever the writer, or his assistants, resets or establishes a corner.

From the county surveyor's records a copy is made of any descriptions of corners established. This search of records is kept uptodate, and the data are transferred to the township portfolio as soon as recorded. All reset corner sheets are filed according to township and range.

Copies of all of the donation-land claim notes for each township are secured, and these are bound along with the section and other notes in the same portfolio.

Whenever a section or a claim is subdivided, a record is made on a sheet giving character of corners and all courses and distances. This gives the surveyor working in that township a ready reference to the work already done and many times saves a great deal of work that might be a duplicate of some already surveyed.

The newspapers are watched; and whenever descriptions are published for Torrens registration work, or other land descriptions are given, they are clipped out and pasted to blank sheets and filed in the proper township portfolio.

All of the above data for a township are bound in covers made of heavy drawing paper cut to a size 9 x 12 in. and with a back ¼ in. in width. On this cover, at

SHEET 1

South Bndry. Between Secs. 35 - 2

Twp. 26 S. R. 5 W.

N.89° 47' W.	Between Section 1 35 and Section 2
2.00	Leave prairie! Enter Oak openings. N & S
7.80	Var. 14° E
20.10	Ravine. C.S
31.00	Top of ridge N & S
40.00	Set Quarter Post from which a
	Yel Oak. 24" Dia. Bears. N48°W. 132 lks.
	W. Oak 18" Dia. Bears. S.81°W. 487 lks
57.00	Top of ridge Begin to descend
69.00	Leave Oak openings, enter prairie
75.00	Leave hill, enter valley
76.30	Trail N & S
80.00	Set Post Corner to Sections 23-34-35 from which a
	W. Oak. 10" Dia. Bears. S.25°W. 78 lks.
	Oak. 5" Dia. Bears. S81½°E. 69 lks
	W. Oak 12" Dia. Bears. N52½°W. 144 lks.
	W. Oak 6" Dia. Bears. N.54°E. 73 lks.

PRINTED FORM FOR SECTION SURVEY NOTES

the top, are printed in large letters the township and range numbers.

In practically all of the Western States, small lithographs of each township, about 6 in. square, can be obtained, and one for the proper township and range is cut down to a minimum size and pasted on the portfolio cover below the title. This plat shows the streams, sections and donation-land claims and acts as a key map for the surveyor.

To facilitate the work of securing a meridian, either by means of a solar instrument or by a direct observation, the writer figures the latitude of each tier of sections in the township; and this is written on the right-hand side of the cover map, each latitude opposite the section line for which it was computed. The longitude for the nearest 10′ is also shown in its correct position on the plat.

A portfolio of the size described can be easily folded in the middle and held with two rubber bands, so as to be carried in the surveyor's pocket.

By having with him the portfolio of notes for the township in which he is called to work, the surveyor has as complete a record as it is possible to have to enable him to reset or establish corners. He also has other data of work done that will be of great value. With these notes he can go from one job to another in the same township without first having to send or go to the office for further notes.

If surveyors in the same locality could be induced to exchange notes of surveys, all data on reset corners or subdivision work could be kept up to date, and each one would have the data in shape for field reference.

Bureau of Standards Corrects the Average Normal Eye

In scientific paper No. 299, issued by the Bureau of Standards, is recorded an attempt to approximate the results of the average normal eye with typical color differences by using a large number of observers. Comparison of light of different colors is supposed to be based on an eye which is both average and normal, and in this paper a comparison between the results obtained by a flicker photometer and by an equality-of-brightness photometer is detailed.

Through the use of the Ives-Kingsbury test solutions, the results obtained on the flicker photometer by a

Times Have Changed Some for Engineers

REGULATIONS

OF THE

ENGINEER'S DEPARTMENT

OF THE

Sacket's Harbor and Saratoga Rail-Road Company.

1.—Every man in this department must be at his post on the work from 7 A. M. until 6 P. M., with the exception of one hour for dinner, between the hours of 12 M. and 3 P. M.

2.—Every man when called upon to go on to the line, or to do office work, or other business relating to the road, by the Resident Engineer, or his superior in command, at any hour before or after the aforementioned hours, will be expected to obey, and go cheerfully and promptly at the time notified—and do as directed.

3.—Every man in this department will board himself, and pay his own board; but when in the woods, camped, the Company will furnish provisions and a cook, for which each man will be charged $10 per month.

4.—No man will be allowed to contract any small bills, and leave the same unpaid to the injury and discredit of others in

11.—Every Resident Engineer, in all cases of doubt as to the manner in which the work shall be done, or where any question may arise as to the same, or where the work does not test or prove instrumentally or mathematically, will inform, by letter, the Chief Engineer and Division Engineer under whom he acts, that the same may be remedied forthwith.

12.—Every Resident Engineer will be held accountable for all delays upon his work for want of having the same staked out properly—and will be expected to answer and attend to all orders from his superiors, with promptness and dispatch.

13.—The Chief Draughtsman will rank as Resident, will keep all his assistants fully employed, and will be held responsible for the acts of the office. The actual time of all men employed under his command will be returned monthly to the Clerk. He will make himself familiar with all the field-books and papers of the office,

ENGINEERS in railroad service who feel that their conditions of service are not all that they might be will perhaps find some comfort in knowing that there has been some improvement in the status of even railroad civil engineers since 1854. On the left is a reproduction of part of a sheet of 16 rules issued July 25, 1854, by the chief engineer of the Sacket Harbor & Saratoga R.R. Others of the rules are of a more technical nature. For example, No. 8 states, in part, more forcefully than grammatically, "Every Resident Engineer will not allow any excavations on any part of his division before the cross-sections are made." The sixteenth rule is a warning that violation of any of the other fifteen will be considered sufficient cause for discharge.

small number of observers can be corrected so as to give normal values with a high degree of accuracy. It was found that on the average, equality-of-brightness measurements also vary in proportion to the test ratio, but erratic variations often overshadow the systematic differences. For sources having relatively high intensity in the blue, flicker values tend to fall below those obtained on the usual standard photometers, but the difference is comparable in magnitude with the uncertainty of the latter values.

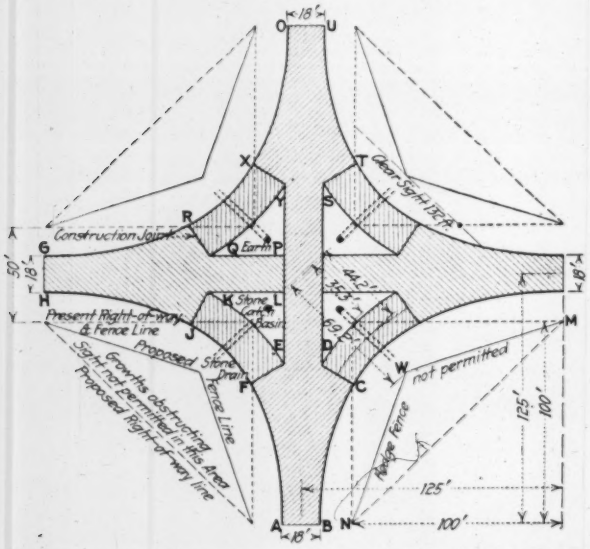
The publication in which this matter is described is entitled "An Average Eye for Heterochromatic Photometry, and a Comparison of a Flicker and Equality-of-Brightness Photometer," and may be secured by addressing a request to the Bureau of Standards, Washington, D. C.

A Modern Intersection Designed for Paved Highways

BY H. E. BILGER

Road Engineer, Illinois State Highway Department, Springfield, Ill.

IT IS appreciated by automobile drivers that the loss of momentum and time due to slowing down to turn a 90° corner within the limits of a 50-ft. highway is about equivalent to that required to travel some 1500 ft. on a tangent of similar grade. Another difficulty with the usually designed intersection is the lack of sufficient clear-sight to enable the driver to realize the approach of a motor on an intersecting road. To overcome these difficulties, the design shown in the accompanying illus-



PROPOSED INTERSECTION GIVES 136-FT. CLEAR-SIGHT

tration has been put forward; and as may be seen, within the limits of the proposed highway the clear-sight is 132 ft., though in reality it would be much more than this if the regulations concerning vegetation were enforced.

While the total area of pavements in the proposed design is 1703.6 sq.yd., only 739.6 of this is necessary for the curve connection shown, the remaining 954 sq.yd. constituting 482 lin.ft. of main-line pavement, 18 ft. wide. Pavements 18 ft. wide being ample for two lines of motor traffic at high speed, they need not be made still wider on curves where speed is necessarily reduced. Likewise, there would seem to be no good reason for widening 10-ft. pavements on curves; 15- or 16-ft. pavements, however, should be widened to 18 ft.

Brick and concrete pavements are generally crowned 2 in. The preservation of this crown at the intersection would prove objectionable, so it should be reduced at the intersection to about ½ in. and tapered out to the full crown in a distance of about 10 ft. in each direction.

Sections like *G, H, J, K, L, P, Q, R* should be built monolithic with the usual convexity of surface at *J, K*, although *J* is depressed. Areas like *H, J, K* will come out warped surfaces easily built by an experienced contractor. The 10 construction joints shown should be nothing more than planes of cleavage. Sections like *K, E, F, J*, which are built last, have their corner elevations fixed by the main pavement. The usual convexity of surface is preserved, therefore, and the inner edge *F, J* is depressed to meet the required elevation.

In areas like *K, L, E* the surface of the ground should be kept about 1 in. below that of the surface of the pavement adjacent. The catchbasins and drains will keep the ground dry.

Dump Road Drags Before Pulling Across Railroad Crossings

MEN operating road drags should dump their drags or unhook one end of the drag chain and pull the drag endwise whenever a railroad crossing must be crossed, according to the "Bulletin" of the Iowa State Highway Commission. Railroad men are complaining that this precaution is not being taken. They have appealed to the commission to do all in its power to get dragmen to watch this point. Pulling the drag across the tracks in the usual manner leaves the space between the rails and the planking on each side filled with dirt and small stones. Each passing train packs this material down, and the next dragging fills the space again. This continues with every dragging; and if a good-sized hard hand-stone becomes packed in this space, there is the best possible situation developed for a derailment. Derailments of hand cars and motor cars are of almost daily occurrence because they are not heavy enough to crush the dirt and stone sufficiently to allow the wheels to retain a safe hold on the rails. There have been many derailments of trains traceable to this cause, but so far, no serious wrecks.

Measure Transparency of Paper and Tracing Cloth

IN RESPONSE to the demands of several Government departments and of dealers in tracing cloth, the United States Bureau of Standards has developed and adopted a standard method for specifying the transparency of paper and tracing cloth. It has issued circular No. 63 stating definitely the form of the specification, explaining its significance, describing the apparatus and method of test, giving general information and instructions to applicants and including a schedule of fees for tests. Copies of the circular may be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C., at 5c. each.

HINTS FOR THE CONTRACTOR

DETAILS WHICH SAVE TIME AND LABOR ON CONSTRUCTION WORK

Use Ice Scraper To Clean Concrete from Wheelbarrows

AN ORDINARY sidewalk ice scraper, with the handle sawed off to convenient length, is proving a useful tool on track-elevation work being carried out for the Illinois Central R.R., in Chicago, by the Bates & Rogers Construction Co. The scraper is used by the man at the form in emptying wheelbarrows, and is stated to be much more convenient for this purpose than a hoe and much lighter than a shovel. The usefulness of the straight blade in line with the handle is shown in the photograph, where it is evident that the motion of the concrete in sliding out of the wheelbarrow is nearly vertical. The tool can be handled quickly in cleaning out the last of the concrete.

TOOL USED FOR CLEANING ICE FROM SIDEWALKS IS ADAPTED TO CONCRETE WORK

Plows and Scrapers Dig Sewer Trench When Labor Runs Short

BY M. H. DOYNE
Engineer, Oklahoma Belt Ry., Oklahoma City, Okla.

TRENCHES for a great length of 12-in. vitrified-pipe sewer, required in connection with some new pens in the Oklahoma National Stockyards, were recently dug with plows and scrapers when sufficient labor to dig them by hand could not be secured.

When a start was made on the trenches, which averaged about 3 ft. in depth, excavating by hand, it developed that the labor available would never be able to complete them in the tough gumbo soil encountered within the required length of time. It was therefore decided to plow the ditches. A plow drawn by two horses soon accomplished the work of about 20 men in a few days. The dirt was removed by going over the trenches with a scraper after plowing them up. It is true that they were dug considerably wider than necessary, but it is thought that the method is much cheaper than the usual way of digging sewer trenches.

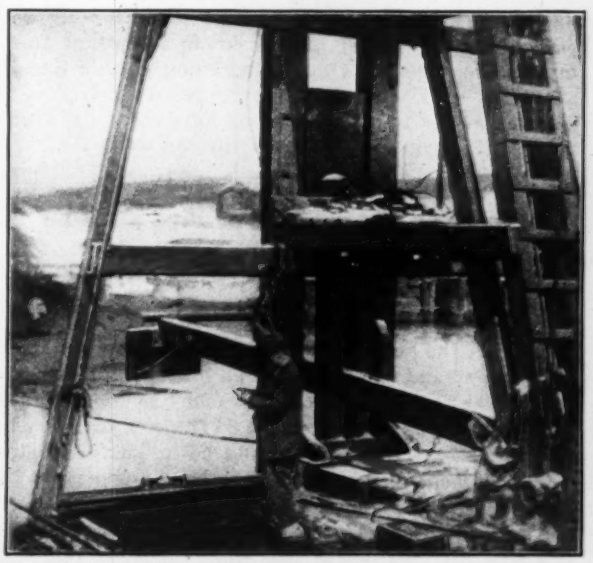
Driver Boat Rakes Mud from Under Pier with Big Hoe

BY GEORGE M. VAN DUZER
Jersey City, N. J.

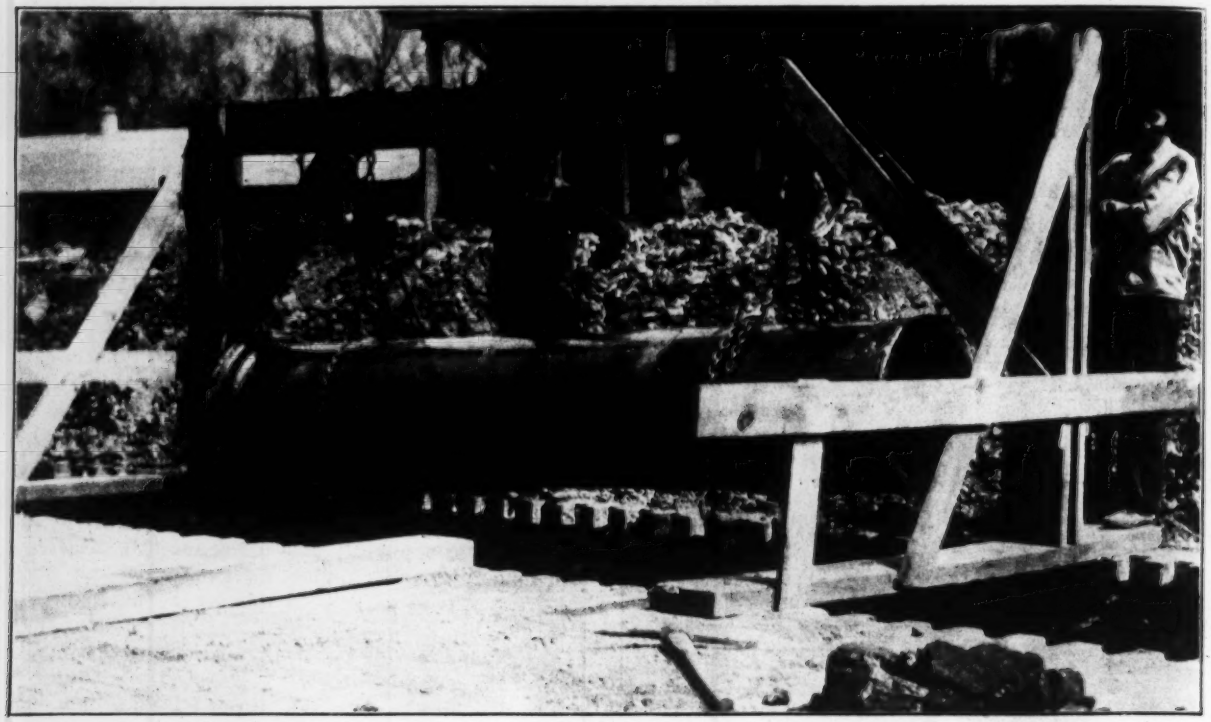
A LARGE hoe made of steel plate and a 6 x 12 timber, swung betwen the leads of a piledriver and handled by its engine, was used recently to scrape stiff mud from under a pier in New York harbor when the mud refused to flow to the dredge until the slip alongside had been dug so deep that there was danger of the ground moving out bodily and taking the foundation of the pier with it.

The pier was built on the site of an older one. The material under it was very stiff meadow mud at an average elevation of 5 ft. above low water, being only about 3 ft. below the deck of the pier. On one side for about half the length of the pier there had been no slip before, and it was necessary to dredge one 300 ft. long and 18 ft. deep below mean low water after the new pier had been completed. The stiff mud, however, held by the piling both of the new and the old piers, refused to flow out to the dredge. The earth pressure became sufficient to move the new pier 6 to 8 in. sideways

To get this mud out from under the pier a heavy steel plate ½ x 30 x 50 in. was mounted and braced on the end



RIG RAKED 300 YARDS OF STIFF MUD A DAY FROM BENEATH PIER



FOUR MEN MOVE AND HANDLE HORSE, LAYING SEVEN LENGTHS OF TWENTY-FOUR-INCH CAST-IRON PIPE AN HOUR

of a 32-ft. stick of 6 x 12-in. timber, as shown in the photograph. The timber was pivoted between the leads of a floating piledriver. This "hoe" was raised and lowered by lines fastened to the rear end of the stick and running through blocks on the leads to drums of the hoist. The entire driver was moved back and forth by lines at the bow and stern. The hoe was raised, the driver pulled up to the pier, the hoe dropped to take a bite of mud, and the driver pulled back, raking the material out into the channel. A strain was held on the line forcing the hoe into the mud while the rig was pulled back. The mud was cut out to a depth of 10 ft. in this way, 300 yd. a day being removed at a cost of about 12c. a yd. The 6 x 12-in. timber was found to be a little light and an 8 x 16 would have stood the strain better. The rig was "invented" by the writer.

Five Men Lay 85 Feet of Pipe an Hour with Horse and Chain Blocks

By A. L. Solleder
Erection Engineer, New York Continental Jewell Filtration Co., Ironton, Ohio

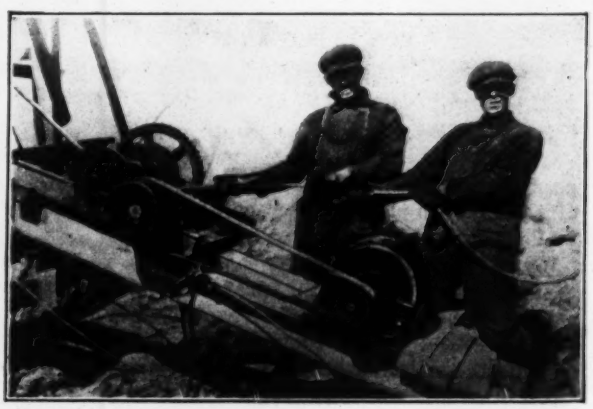
WITH the horse shown in the accompanying photograph and two sets of chain blocks a foreman and four laborers were able to lay as many as 100 ft. of 24-in. pipe per hour and to average 85 ft. per hour in laying the entire two miles of 20- and 24-in. cast-iron pipe. The four men were easily able to handle and move the horse. The two lines of pipe were laid in a wide ditch, spanned by the horse, the frame of which was built to one side of the center so that when turned in one position it would be over the center of the 24-in. line and when turned in the opposite position would be ready to handle the 20-in. pipe. In laying the pipe two 4 x 10-in. skids 10 ft. long were placed across the ditch under the frame, the pipe rolled on them, the chains adjusted and the pipe raised before removing the skids.

Although the 24-in. pipe weighs about 3400 lb. per 12-ft. length, two 1-ton Yale triplex chain blocks were used because of their light weight. The trench for the pipe was 3 or 4 ft. deep. The contractors on this portion of the work are Scherer, Mountain & Grimes, and the pipe laying was directly in charge of J. A. Grimes.

Winch and Motor Rigged Up To Spud Down Boring Pipe

By L. R. Talbot
Three Rivers, Que.

IN MAKING test borings with a 4-in. pipe to a depth of about 100 ft., some very hard clay was struck and the ordinary water-jet methods used would not get the



SPUDDING DOWN A BORING DRILL WITH IMPROVISED RIG

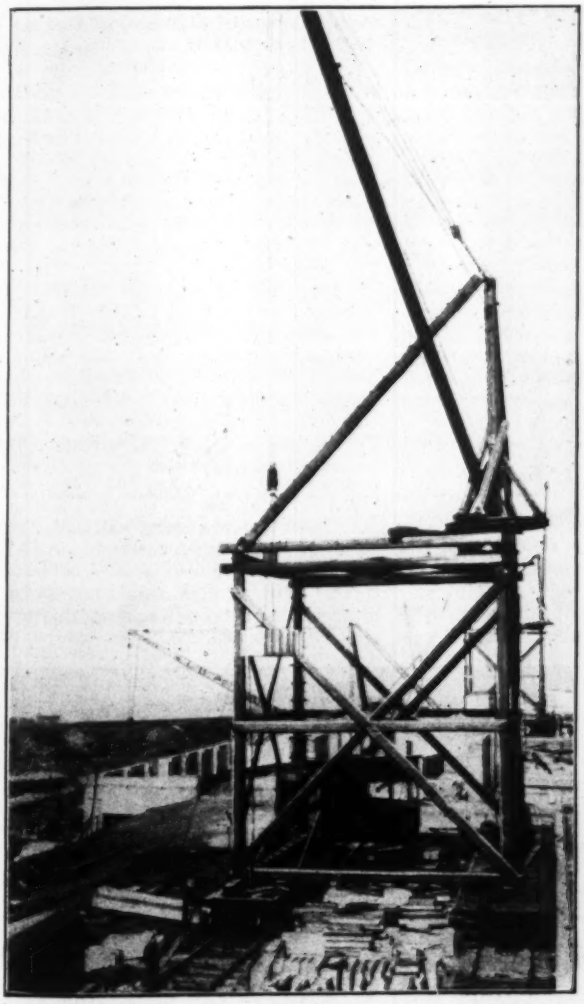
pipe down, so a chisel was rigged onto the pipe end and the pipe spudded down. At great depths, however, the pipe was too heavy for hand spudding; and when a tackle was used, the overhaul lightened the blows and made the work very hard.

For these depths the rig shown in the view was put together on the job. It comprised a 3-hp. motor and an old winch, or crab. The winch handle was taken off and a pulley babbitted onto its shaft. The winch and motor were then bolted down to the inclined frame and connected up. Using a single line from the pipe over a snatch block and with two turns around the drum, one man could spud much faster and easier with the rig than three could with the old hand-operated tackle.

In driving the pipe through quicksand the same rig was used as a piledriver, with a 12-in. birch log, 5 ft. long, as a hammer.

Traveling Tower Derricks Are Mounted on Railway Cars

CONSTRUCTION work on the Field Museum, Chicago, is being done by means of six traveling derricks rigged up on the job by the Norcross Brothers Co., of Worcester, Mass., which has the contract for masonry. The derricks are of timber construction.



MOUNT TOWER DERRICKS ON FLAT CARS TO PLACE BUILDING STONE

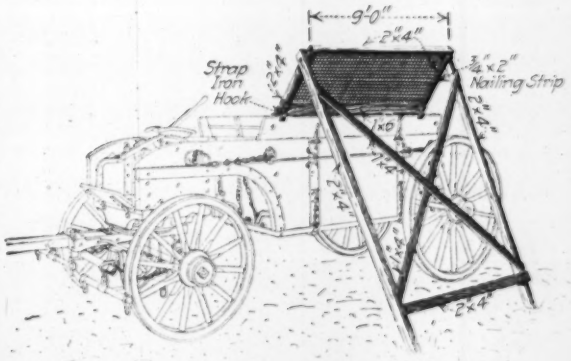
Each derrick has a tower 27 ft. square, mounted on a pair of flat cars on parallel tracks spaced 27 ft. c. to c. The height from base of rail to top of tower is 40 ft. At one corner of the tower is a mast 28 ft. high, supported by stiff-legs. This has a 10-ft. bullyheel for swinging and carries a 56-ft. boom. The hoisting capacity is 7 tons, or 5½ tons at the maximum reach of 54½ ft., with the boom practically horizontal. The hoist, with its 21-hp. electric motor, is mounted in a cab at the base of the tower.

These derricks can handle and place from 550 to 700 cu.ft. of marble blocks in an 8-hour day. For unloading the marble from cars, the Norcross Brothers Co. has five large stationary derricks of the stiff-leg type. The Thompson-Starrett Co. has the general contract, and D. H. Burnham & Co., of Chicago, are the architects.

Wagon-Side Screen Cuts Cost of Handling Gravel in Half

By Donald A. Thomas
Michigan State Highway Department, Lansing, Mich.

A SCREEN that is supported by props and by one side of the wagon being loaded is popular in certain sections of Michigan for screening gravel for roadbuilding purposes, because of its saving in cost over screening the gravel on the ground and handling it again to load it into wagons. Using the ordinary masons' screen, the cost of this work averages about 44c. per yd. for the screened product, including loading. About one-third of the material handled is waste. By throwing the material against the wagon screen, allowing the waste to drop to the ground and the screened gravel to roll into the wagon, the cost given is cut to about 22c. per yard.



SCREEN AT FAR SIDE OF WAGON SAVES REHANDLING GRAVEL

The screen used is 3 ft. wide, and the length of the dump wagon is usually about 9 ft. The frame is made of 2 x 4-in. scantling with two cross-braces of the same material. It is covered with screen wire having ¼-in. to ½-in. mesh, which gives a satisfactory product. The angle at which the screen is set can be varied to suit the material being dug. The lower edge of the screen is provided with hooks to hang on the side boards of the wagon, while the other side of the screen is supported by posts hinged on bolts to the edge of the frame.

NEWS OF THE WEEK

CURRENT EVENTS IN THE CIVIL ENGINEERING AND CONTRACTING FIELDS

Government Will Erect Nitrate Plant

Time Needed To Build Water-Power Plant Forces Consideration of Other Processes

Secretary Baker announced July 17 that a plant for the production of nitrates from atmospheric nitrogen would be constructed immediately at a cost of about $4,000,000 and that water power would not be used. Discussion of possible sites is closed temporarily while the site committee of cabinet officers is making engineering studies.

Secretary Baker's statement follows:

"By direction of the President, certain plants will be immediately constructed for the production of nitrate from atmospheric nitrogen. The plants to be constructed do not involve the use of water power, but use a process which is a modification of processes previously known.

"Nothing further can be said at this time about the process or the location of the works which are to be constructed. Of the total amount appropriated by Congress, namely, $20,000,000, substantially $16,000,000 remains undesignated as to its expenditure by the President."

Informally, officials explained that the announcement did not mean that the idea of building a water-power nitrate plant had been permanently abandoned. Several years would be required to build a water-power plant and for that reason it was determined that for urgent war purposes it would be necessary to adopt one of other processes of producing nitrates.

Indiana Highway Commission Appoints Engineer

The new State Highway Commission of Indiana, after approval by Governor James P. Goodrich, has just selected William S. Moore, city engineer of Grand Rapids, Mich., as the new state highway engineer, who will supervise approximately 2000 miles of main highway road construction in Indiana between now and 1921. The Indiana legislature, in 1917 session, enacted the new state highway commission law. Mr. Moore's salary will be $4500 a year, and he will take office at once. L. H. Wright, of Indianapolis, chairman; Haines Egbert, of Goshen; Lewis Taylor, of Boonville, and David C. Jenkins, of Kokomo, are the members of the commission.

Mexican Engineers Will Examine Lower California Peninsula

A commission of engineers recently named by the Mexican Government for the purpose of studying and reporting on the natural resources of Lower California and the best and most practical methods of developing them, is now at work. The commission is headed by Manuel Balarezo and David Zarate. They will investigate the mineral deposits generally, kelp beds, fishing zones and the oil and artesian-water possibilities for fuel and irrigation purposes.

In commenting on the policy of the Mexican Government, Mr. Balarezo stated that the Government would not issue any concessions of a monopolizing nature, but that the policy will be to approve such development as will result in the greatest benefit.

Will Rebuild Galveston Causeway at Once

Contract Awarded July 2 on Basis of Arch Plan—Cost Not To Exceed $1,725,000

Work will start immediately on the reconstruction of the Galveston causeway, partly destroyed by the storm of Aug. 16-17, 1915. The Larkin & Sangster Co., Inc., of Buffalo, N. Y., was awarded the contract July 2, on the basis of the arch type of design submitted by William Mueser, of the Concrete-Steel Engineering Co., of New York City. The total cost is not to exceed $1,725,000. A bond of about $550,000 is required. If the contractors can finish the structure for less than $1,300,000 for actual cost of labor and materials, they are to have in addition to their bonus of $120,000, 20% of such saving in cost as is effected.

The three steam roads will bear 45% of the cost and occupy 27 ft. of the 62-ft. width; the interurban will pay 22% and occupy 13 ft., while the county will pay 33% and have 22 ft. for its roadway.

An option on $300,000 worth of steel with the Concrete-Steel Engineering Co. was immediately taken up, saving $54,000 owing to a recent advance in price.

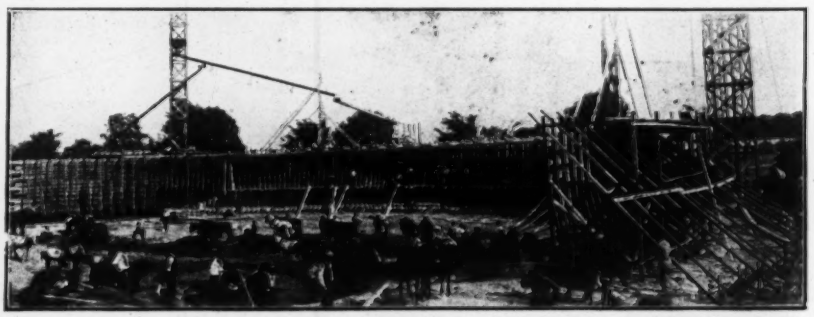
The length of the new construction will be about 5900 ft., 2240 ft. from the Galveston end and 3605 ft. from the mainland. Already 55 ft. has been repaired. There will be 84 new arches resting on piers 10 ft. thick supported on nests of piers driven 33 ft. The drawbridge and 2446 ft. withstood the storm of two years ago.

Rushing Water-Works at Fort Benjamin Harrison

A circular 3,000,000-gal. reinforced-concrete, concentrically baffled reservoir and coagulating basin is being constructed at Fort Benjamin Harrison. It is identical with the one at Bedford, Ind., and is being built from the same drawings. The Bedford basin was described in *Engineering News-Record*, July 5, page 31. Under recent date C. H. Hurd, consulting engineer for the water-works at the fort, writes as follows:

"The work is well under way and we are now engaged in sinking the well pit on the east bank of Fall Creek, about two miles above the reservoir site and entirely above the Government reservation. This pit will be 24 ft. square and from 20 to 30 ft. deep, depending on the character of the underlying gravels. It will be connected with a covered gallery, which will be about 18 ft. deep and 150 ft. long. This is to be used as an infiltration gallery, as well as a pipe gallery, for the intake to Fall Creek. The purpose of the infiltration well and gallery is to produce clear water at times of flood and high turbidity in Fall Creek."

The general plan was suggested in the article on the work at the fort, June 7, page 506.



SHAPING THE BOWL-SHAPED BOTTOM OF ARMY-CAMP RESERVOIR AT SAME TIME AS FIRST SECTIONS OF CONCRETE ARE POURED

Steel Men Promise Entire Product for War Needs

Conference of Manufacturers and Officials Will Set Price To Insure Only a Fair Profit

At a conference July 11 between the committee of the American Iron and Steel Institute and the Secretary of War, the Secretary of the Navy, Chairman Denman, of the Shipping Board, and Bernard M. Baruch, of the Advisory Commission of the Council of National Defense, further discussion was had of the prospective demand upon the steel industry of the country for supplies of various steel products for carrying on the war. The steel men repeated their assurance that their entire product would be available for the need and that they were doing everything possible to stimulate an increased production and speed deliveries of needed material.

The price to be paid for the iron and steel products furnished was left to be determined after the inquiry by the Federal Trade Commission is completed, with the understanding that the price, when fixed, would insure reasonable profits and be made with reference to the expanding needs of this vital and fundamental industry.

The representatives of the Government assured the committee of the steel institute that it was the intention of the Government to distribute the war requirements over the entire iron and steel producing capacity of the country.

Steel Men in Attendance

The heads of a number of the largest steel and iron companies in the country were present, the following attending the conference: Elbert H. Gary, chairman of the United States Steel Corporation; James A. Farrell, president of the United States Steel Corporation; Charles M. Schwab, chairman of the Bethlehem Steel Corporation; E. G. Grace, president of the Bethlehem Steel Corporation; J. A. Burden, president of the Burden Iron and Steel Co.; E. A. S. Clarke, president of the Lackawanna Steel Co.; H. G. Dalton, president of Pickands, Mather & Co.; A. C. Dinkey, vice president of the Midvale Steel and Ordnance Co.; J. A. Topping, president of the Republic Iron and Steel Co.; James B. Bonner, representing the American Iron and Steel Institute.

Gross 15%, Net 3.5%—Increase in Rail Revenues for May

Railroad operating revenues for May on 178 railroads, embracing 227,514 miles, as reported by the Interstate Commerce Commission, were $337,869,250, as compared with $294,517,994 for May, 1916. Operating expenses were respectively $233,147,873 and $193,348,746, and net revenues were $104,721,377 and $101,169,248. In other words, while gross revenues were 14.7% higher this year than last, net revenues were only 3.5% higher.

Local Engineers Condemn Methods Used on Spokane Bridge

After the failure of the Post St. Bridge in Spokane, Wash., on Feb. 6, 1917, it was pointed out in both *Engineering News* and the *Engineering Record* that there were serious defects in construction which could hardly have resulted in anything but failure. Since then the local members of the American Society of Civil Engineers have adopted as official a report made by a special committee appointed to investigate the collapse. The report confirms the earlier impression of poor work.

The special committee states that the failure was due to the fact that the "centering of the falsework was dangerously and poorly constructed, and that these defects were especially noticeable in footings, joints and bracings. We know that the structure was inadequate—there can be no question on that point—and from the data available, it seems fair to say that this inadequacy could have been foreseen."

Ben J. Garnett, city inspector on the bridge, Peter Mogensen, consulting engineer, and W. L. Maloney, a local contractor made the investigation and report. Excerpts from the document follow:

"As has already been intimated, the collapse of the bridge seems clearly to be a case in which the lack of stability and safety could readily have been ascertained by a competent engineer.

"The work was being done by the city, under the supervision of the city engineer, but through the agency of a contractor, and while the city would be responsible for the safety of the completed bridge, it appears to have been the opinion of the city attorney that the engineer could not intervene in or request modifications of the contractor's plans for the erection of the centering, even in the interest of safety, without assuming for the city, responsibilities which were intended to rest with the contractor.

City Engineer Should Have More Authority

"Had the city, through the city engineer, been responsible for the safety and sufficiency of temporary structures as well as for the bridge proper we feel confident there would have been no failure, and the additional cost of the falsework would probably not have exceeded a thousand dollars.

"We, therefore, recommend that in all future contracts made by the city for the erection of engineering or architectural works especial provision be made for the supervision of all parts of the structures, temporary and auxiliary as well as permanent, by the city engineer or architect in charge, to the end and to such an extent that the city does not only secure proper compliance with plans and specifications, but that it also through its own representative, makes certain that adequate provisions are made for the safety of all persons employed on its work."

Colonel Littell Issues Statement

Brands as False Editorials and News Items Attacking Contractors on Army Cantonments

Under such headings as "Government Hurting Business," "Disturbing the Labor Market," etc., a series of editorials and news items are appearing which are founded almost entirely upon falsehood, and the influence of which is extremely pernicious. They charge in effect that the contractors for the cantonments are paying more for material and for labor than is necessary in order that they may thereby increase the profit to themselves, which is figured upon the basis of a percentage on the cost of the operation; and they imply that the War Department has taken no precautions and is doing nothing to prevent deliberate fraud.

Such articles, says Col. I. W. Littell, of the Quartermaster Corps, officer in charge of cantonment construction, are written either with a reckless disregard of truth or a deliberate purpose to hamper the Government in this work. The contractors for building cantonments were chosen with the greatest care; the War Department had the assistance of the Council of National Defense in making the selections, and in every instance the contractors have had the widest experience and enjoy the highest reputation in their communities.

Government Protected

The War Department has taken every precaution to safeguard the interests of the Government in the carrying out of these contracts. A provision is contained in each contract which prevents the contractor from making any departure from the standard rate of wages being paid in the locality where the work is being done without the consent and approval of the Government. The prices paid for the various materials which go into the construction must, by the terms of the contract, receive the approval of responsible representatives of the Government.

In the methods adopted by this office in carrying out these contracts all material is carefully inspected both as to quality and amount, and an accurate record of the hours of labor of every employee on the job is made.

Of course the calling of approximately 100,000 men to build these cantonments must necessarily "disturb the labor market" in the localities from which they are called. Some inducements must be offered employees to do this temporary rush work, which in most cases must be done at a distance from their homes. Consequently an increase in wage is about the only method that can be employed to secure the necessary number of mechanics and laborers. However, it has rarely been found necessary to consent to the increase of wage more than 10% above the prevailing rate in any locality.

Government To Build New Ocean Terminals

Defense Council Creates Commission To Study and Provide for Needs of Emergency Fleet

The Council of National Defense has created an advisory commission on terminal facilities, to work with the general munitions board and with the subcommittee of the board on storage facilities. The committee is making a study of the ocean terminals of the country for the use of war-supply vessels and it is understood in Washington that new terminals are to be built especially for the assembly and loading of supplies for American troops abroad and for the allies.

Existing ocean terminals are reported to be entirely inadequate for the demands being made upon them, based on the exports before the President's embargo was put into effect. These, it is expected, will be cut down to the extent of $30,000,000 a month, on the present plans of the export council and its advisory commission, in accordance with the President's proclamation. These exports will be further reduced when additional embargoes are laid, as is expected to be done. The exports will greatly increase in volume, however, as soon as the ships to be produced by the Emergency Fleet Corporation and the Shipping Board are provided, and the advisory commission on terminal facilities will make a study of this subject as well as the physical engineering features connected with the present terminals and the probable needs of the future. Unnecessary freight hauls will be eliminated, it is expected, releasing cars and locomotives for inland transportation.

All Ports Are Represented

Francis Lee Stewart, consulting engineer, formerly chief engineer of the Baltimore & Ohio R.R., who represents the port of Baltimore, will be the chairman of the new organization. Representatives for New Orleans and Boston have not yet been selected. Others so far named to serve on the new organization are as follows: B. F. Cresson, consulting engineer, 50 Church St., New York, designated by the State of New Jersey to represent the New Jersey sections of the ports of New York and Philadelphia; R. A. C. Smith and Charles W. Staniford, respectively commissioner and chief engineer of the Department of Docks and Ferries of New York City, designated by the Mayor of New York to represent New York's waterfront and the port of New York; J. B. Locke, secretary of the Newport News Chamber of Commerce, designated by the Virginia Corporation Commission and the Mayor of Newport News; and W. A. Cox, secretary and traffic manager of the Norfolk Chamber of Commerce, designated by the Virginia Corporation Commission and the Mayor of Norfolk.

Announce Award of the Nelson Prizes in Plumbing

The committee in charge of the award of the Nelson prizes in plumbing announces that the papers of the following have been awarded the prizes: First prize, $100, awarded to Thomas J. Claffy, assistant chief sanitary inspector, Health Department, Chicago, Ill., for a paper entitled "Plumbing"; second prize, $50, awarded to J. W. Anderson, student graduating in the class of 1917 from the Massachusetts Institute of Technology, for a paper entitled "A Study of the Different Types of Pipe Used in the Disposal of Rain Water from Buildings"; third prize, $50, awarded to Walter E. Ward, instructor, North Dakota Agricultural College, for a paper entitled "Water-Closet Connections."

These prizes were awarded through the courtesy of the Cast Iron Soil Pipe Makers Advertising Association on Aug. 1, 1916, the only restriction being that they should be given for the best papers on subjects having to do with the theory or practice of plumbing. The personnel of the committee having the awards in charge is George C. Whipple, professor of sanitary engineering, Harvard University; Dwight Porter, professor of hydraulic and sanitary engineering, Massachusetts Institute of Technology; Gifford Le Clear, of Densmore & Le Clear, engineers and architects, Boston, and Harry Y. Carson, of the Central Foundry Co., New York.

St. Louis Engineers' Society To Give Engineer Regiment Colors

National and regimental colors are to be presented to the Second Engineers, National Army, by the Engineers' Club of St. Louis. Every member of the club is to have the privilege of contributing to the cost ($350), so that the soliciting notice asked for $1 only from each member. Thirteen members of the club are officers in the Second: Majors, F. G. Jonah and J. A. Laird; captains, F. W. Greene, F. E. Foster, J. W. Skelly, F. T. Kennedy and W. W. Burden; lieutenants, S. M. Smith, J. H. Brooking, H. H. Downes, J. J. Calahan and C. C. Brown.

Older Men Officer Engineers' Business Association

Following several adjourned stormy sessions in Chicago of the annual convention of the American Association of Engineers over the adoption of a new constitution, the organization finally put the matter in the hands of Isham Randolph, W. H. Finley, T. C. Williams, H. G. D. Nutting and R. C. Yeoman, who succeeded in ironing out the difficulties and getting their proposed constitution adopted July 13 unanimously. Its main provision is for enlarging the board of directors from five to fifteen members, but the board may appoint five members to actively manage the affairs of the association. Associates—those who are not necessarily engineers but interested in engineering affairs—may be admitted up to 10% of the certified membership.

To give a clean slate the old board resigned in a body and the following were unanimously elected July 13: President, Edmund T. Perkins, consulting engineer; vice presidents, W. H. Finley, chief engineer, Chicago & Northwestern Railway Co., and Isham Randolph, consulting engineer; two-year directors, P. P. Stewart, Dean R. C. Yeoman, W. W. DeBerard, C. A. Soans, H. G. D. Nutting and G. C. Dooge; one-year directors, F. H. Newell, L. K. Sherman, H. W. Claussen, O. F. Gayton, H. D. Whipple and A. C. Cunningham.

A resolution asking the board to found a Patriotic League whose aims would be to make a census of engineers and to look after the dependents of enlisted men was passed. Coöperation with other societies will be sought.

Construction of Federal Armor Plant Postponed

The building of the $11,000,000 armor plate plant and $1,500,000 naval laboratory will be deferred until the end of the war, according to an announcement from Washington. Secretary Daniels is convinced that the need for steel plants already in operation is so great that diversion of any of it to any of these projects would greatly hamper war preparations.

U. S. NEEDS TECHNICAL MEN FOR SERVICE DURING WAR

Position	Service	Salary	Date of Examination	Cir. No.
Land classifier	Geological Survey	$1080–$1200	.....	1401
Inspecting machinery	Navy	3.52–6.00 per day	.....	1405
Topographic draftsman	Coast and Geodetic Survey	1000–1200	July 25	1406
Mechanical engineer	Interstate Commerce	720–1680	July 25	1407
Signal engineer	Interstate Commerce	720–1680	July 25	1408
Structural engineer	Interstate Commerce	720–1680	July 25	1409
Telegraph and telephone engineer	Interstate Commerce	720–1680	July 25	1410
Engineer of tests	Ordnance	1000–2400	.....	1411
Cement inspector	Bureau Standards	900	July 25	1450
Physical labor helper	Bureau Standards	600– 840	July 25	1451

DEEP WATER NOW CONNECTS PUGET SOUND AND LAKE WASHINGTON, A DISTANCE OF EIGHT MILES

Lake Washington Government Canal Is Opened

Ceremonies Mark Completion of Plans Recommended in 1856 by General McClellan

A marine parade and open-air festival in Seattle, Wash., on July 4, marked the official opening of the Lake Washington Government Canal. Completion of the canal fulfills an ambition cherished by Seattle since Gen. George B. McClellan, in 1856, as a Government engineer, recommended to the Secretary of War, Jefferson Davis, the construction of a waterway connecting Lake Washington, through Lake Union, with Puget Sound. In 1890 the Government surveyed the canal route from salt water on Seattle's west shore line to fresh water on the eastern city boundary. Later, the citizens acquired the right-of-way and presented it to the Government. In 1910 the Government appropriated $2,075,000 to build the locks, and in November, 1911, excavation began at the expense of the city, county and state. Since then, four million yards of dirt have been dredged and 230,000 yd. of concrete used in the lock and other needed construction. The total cost of the canal, including right-of-way was $5,000,000.

The improvement lies entirely within the City of Seattle and extends from Puget Sound, through Shilshole and Salmon Bays, and Lake Union to Union Bay, on the western shore of Lake Washington. The distance by channel from deep water, Puget Sound, to deep water, Lake Washington, is approximately 8 miles.

The Fremont Ave. bridge, crossing the canal at Fremont Ave., is 242 ft. long between trunnions, clearing the channel at right angles to the axis of the canal. The span is raised and lowered by four 100-hp. Westinghouse motors under automatic control. The structure is of steel and concrete and was designed by F. A. Rapp, bridge engineer, under direction of A. H. Dimock, city engineer.

Report Adversely on Proposed Lake Traverse Canal

Chief of Engineers, United States Army, has reported adversely on the proposed canal and lock between Lake Traverse and Big Stone Lake, which lie on the boundary line between South Dakota and Minnesota, on grounds that the interests of navigation are not sufficient to justify coöperation on the part of the Government.

The board of engineers points out that as the improvement was petitioned chiefly to provide relief from flood conditions, it is a matter for consideration under the terms of the flood control act. Forty-five hundred dollars is the estimated cost, made by the district engineer, for a survey to supplement available data and develop the plans.

The peculiar situation of these lakes has made them a tempting subject for promoters. They are separated by a distance of about 4½ miles. The divide between them is about 4 ft. above high water in Lake Traverse and the difference in elevation of the two lakes at low water is about 8 ft. It has been repeatedly proposed to drain the waters of the Red River of the North and Lake Traverse, through controlling works, into Big Stone Lake and the Minnesota River and utilize the flow along the Minnesota for power purposes. International complications have probably prevented these promotion schemes from going through, for Lake Traverse and the Red River of the North flow into the Hudson Bay.

Final Estimate of Consulting Engineer Binding on City

In a decision of the Supreme Court of Nebraska recently handed down in the case of the Katz-Craig Contracting Co. against the City of Cozad, it was held that the city must pay the contractor the full amount of the final estimate given by the engineer whom the city retained to supervise the work, and that claims for deductions set up by the city after the final acceptance of the work by this engineer were not valid. The contract plainly provided that final payment should be made upon approval and acceptance of the work by either the city council or the engineer. It appeared that the engineer accepted the work and that the city council intended to do so, but was prevented from making the final payment by the mayor. The city, however, took over the waterworks and built under the contract, and used it from the time of its acceptance. The court held that in any case the city was estopped by this action from claiming that the work was not satisfactory.

An important part of the decision was to the effect that, where a supervising engineer is employed by a city to inspect and approve construction work, and is named as the sole arbiter between the contractor and the city, his final estimate is binding upon the city as well as upon the contractor, unless fraud can be shown.

The case has been pending since 1911, although the amount involved was a little less than $7000.

Breaks in Imperial Valley Levee Cause Slight Damage

Two breaks occurred on June 30 in the Saiz levee of the Imperial Irrigation District in California, about 28 miles southeast af Calexico. On July 4 the total width of the gaps amounted to 200 ft., and the danger was then believed to be past. The break was largely due to a wind storm which came up when the water level was near the crest of the levee, causing waves which attacked the already saturated embankment.

About 800 men were engaged in the fight to hold the levees at the several points threatened. They worked under the direction of C. K. Clarke, chief engineer of the district, and C. N. Perry, chief assistant. The land inundated by the breaks is not cultivated and practically no damage to crops resulted. The overflow made its way southward, and a 600-ft. cut was made in another levee to allow it to escape into Volcano Lake.

Volcano Lake stood at El. 41.75 for several days and the levee, whose top is at El. 43.7, became pretty well soaked. However, trains continued to run on the tracks extending the full length of this levee, transporting men and bringing trainloads of rock from the quarries at Hanlon Heading.

Volcano Lake levee is the sole barrier to the reëntry of the Colorado River floodwaters into New River and thence into Salton Sea. The land behind the levee is about El. 32.0, or 9.2 ft. below the recent high-water level in the lake.

American Firms Will Build 500 Locomotives for Russia

A contract for 500 large freight locomotives has been placed by the Russian Government with the American Locomotive Co. and the Baldwin Locomotive Works. The contract is divided equally between the two companies and involves about $30,000,000. The locomotives will be of the decapod type, 5-ft. gage. Delivery is to be at the rate of 100 monthly, beginning February, 1918.

Break in Los Angeles Aqueduct

A break occurred in the Los Angeles aqueduct, July 7, on a hillside at a point near Owens Lake, about 26 miles north of the Haiwee reservoir and approximately 180 miles northeast of Los Angeles. The cause of the break is said by William Mulholland, chief engineer of the Water Department, to have been an earthquake which took place at about 3 a.m. on that date. Following the break, the water-soaked earth gave way beneath the line and a landslide from above carried away about 160 ft. of the solid concrete flume. Within a few hours a construction gang, under the direction of Mr. Mulholland, who had hurried from Los Angeles, had installed a steel pipe line, and a flow of about 10,000 miners' inches was again turned on. At the time of the break a sufficient supply of water was stored in the reservoirs along the aqueduct to supply all the needs of the city, and the news of the break was not generally known in Los Angeles until after repairs had been made. The landslide settled in an old borrow pit which had been made when the railroad was constructed below the aqueduct. A new section will be constructed at once, and Mr. Mulholland states that this borrow pit will be filled with material taken from above the pipe line, thus lessening the chances of another landslide.

Santa Barbara To Complete Water-Works Building

By a vote of more than three to one Santa Barbara, Calif., has authorized a bond issue of $590,000 to complete the Gibralter dam across the Santa Ynez River and to construct a 36,000,000-gal. distributing reservoir and provide supply mains. Work on the dam will be postponed until next spring, but contracts for the reservoir will probably be let this fall. The Mission tunnel through the Santa Ynez Mountains and the foundations for the Gibralter dam have been completed. J. B. Lippincott, Los Angeles, is engineer for all the improvements.

Hammond, Ind., Loses a Proposed Sewer System

A proposed intercepting-sewer system for Hammond, Ind., has been killed recently by the Supreme Court of Indiana, the objections having been against payment for this by special assessment. Contracts amounting to about $800,000 were let in 1913, but no work has been done. The sewer system was to discharge into the Calumet River and through this and the Sag Channel into the Chicago drainage canal. It is stated that the project will probably be taken up again on some more acceptable basis. W. S. Shields, of Chicago, was consulting engineer.

Army Wants Fire Chief for Forces in France

How thoroughly the army in France will resemble a huge engineering or industrial organization is well shown by recent advices that the services of fire chiefs are being sought for overseas work. The secretary of the National Fire Protection Association, Boston, Mass., makes announcement as follows:

"The Government wants at once for service in France a fire chief and assistant fire chief (salaries $1500 and $1200 with quarters and subsistence) who can speak French and who are capable of organizing a fire department in connection with warehouses containing military stores. The salary cannot be considered as any indication of the grade of men wanted. Personal character must be above the average. A chance for patriotic service."

Denver & Rio Grand Announces New Pension System

The Denver & Rio Grande R.R. Co. has announced that a pension system will be put into effect July 1 on that road, whereby all employees who have been connected with the company for more than twenty years, and who have reached the age of seventy years, shall be retired on a pension. A clause is also incorporated in the decision that all officers or employees who have been in the employ of the company for more than twenty-five years and who have become permanently incapacitated may be retired and pensioned regardless of their age.

Anti Stream-Pollution Suit Won by Texas City

On June 28 the Fifth Court of Civil Appeals affirmed the decision of the District Court in the suit of A. L. Brewster against the City of Forney, Tex., in which damages had been claimed for alleged injury to property by the installation of a sewage-disposal plant. As the city had agreed to change any part of the plant that was necessary to conform to the anti-pollution of streams law, and was endeavoring to do all that was possible to comply with the law, the court held that the city should not be liable. Although the jury found that the property had suffered actual damages, the court gave judgment for the city. The Court of Civil Appeals is just below the State Supreme Court.

PERSONAL NOTES

HOMER HAMLIN, city engineer of Los Angeles since August, 1906, has been removed from office by the Board of Public Works of that city. For some time there has been disagreement between the board and the engineer's office, which finally culminated in a resolution adopted by the board on July 10 declaring the office vacant. In an announcement by the board commenting upon the removal there appears a statement that "the board wishes Mr. Hamlin well. We recognize that he gave the city much valuable service during the past years." The immediate reasons for the removal involve reports on paving work in which the recommendations of the engineer were contrary to the wishes of the Board of Public Works.

ARTHUR M. SHAW, consulting engineer, New Orleans, who served in the Second United States Volunteer Regiment during the Spanish-American War, has been commissioned as major in the Engineer Officers Reserve Corps.

L. E. MYERS, consulting engineer and president of the L. E. Myers Co., of Chicago, owning the Ironwood & Bessemer Railway and Light Co. and Ironwood (Mich.) Water Co., has been called to Washington to assist H. C. Hoover, of the Food Control Council. He will take charge of the bureau of special investigations.

ROBERT W. ADAMS was elected president of the Providence Engineering Society at its recent annual meeting. Graduating from the Worcester Polytechnic Institute in 1904 and receiving the degree of electrical engineer in 1908, Mr. Adams has been connected with the General Electric Co. for the past nine years and is at present manager of the Providence office.

M. E. PARET, who resigned from the position of district engineer with the Interstate Commerce Commission, has opened an office as a consulting engineer on railway projects and railway valuation work. Mr. Paret got his early experience in railroad location and construction work with the Lehigh Valley R.R. and on the Pennsylvania Lines East and West of Pittsburgh. Several years on river and harbor work for the Government on the Atlantic Coast, he became locating engineer and later chief engineer of construction for the contractors who were building the Kansas City Southern Ry. from 1895 to 1901. Mr. Paret became chief engineer of the Kansas City, Mexico & Orient R.R. in 1901 and located 1700 miles of that road, building 800 miles. In private practice from 1909 to 1913 on railroad and hydro-electric projects, he was appointed district engineer with the Interstate Commerce Commission in 1914, which position he held until the time of his resignation.

PAUL HOOKER has resigned as first assistant engineer, water-works and sewage, in the Pennsylvania State Department of Health, to join the engineering staff of the Hooker Electro-Chemical Co., at Niagara Falls, New York.

PHILIP GUISE has been appointed county engineer of Sussex County, New Jersey, vice HARVEY SNOOK, now serving as lieutenant in the United States Army. Mr. Guise will also serve as town engineer for Newton, New Jersey.

D. KIRK, until recently checker and designer on rolling mill machine drawings for the Carnegie Steel Co., at Homestead, is now engaged in similar work with the Bethlehem Steel Company.

EDWARD G. KANE, commissioner of public works, Butte, Mont., has resigned, and W. H. ELLIS has been appointed to succeed him.

MARK T. KRAUSE has been selected to handle such engineering questions as may arise in the building of the large industrial home section known as Sawyer Park near Williamsport, Penn. Mr. Krause has had much experience in the construction of house and storm-water sewers, streets and reinforced-concrete bridges in connection with work of a similar character at Williamsport at Spirit Lake, Idaho, and at Newport, Wash., in addition to four years of experience in railroad work and private practice.

ALONZO B. REED, formerly with CHARLES T. MAIN, consulting engineer, Boston, Mass., is now associated with the power transmission sales office of James Hunter Machine Co., with headquarters at 70 Kilby St., Boston.

OTTO J. SWENSSON, city engineer of Summit, N. J., has resigned to enter the employment of the Aluminum Co. of America, with headquarters at Pittsburgh.

C. C. COTTRELL has been appointed assistant highway engineer of Nevada. Mr. Cottrell was formerly connected with the California Highway Commission.

W. H. ELLIS, formerly assistant city engineer of Anaconda, Mont., has been appointed Commissioner of Public Works of the same place, succeeding EDWARD G. KANE, resigned.

HENRY G. LEHRBACH, formerly of the Dunn Wire-Cut-Lug Brick Co., has been appointed assistant civil engineer of the United States Navy. For a number of years Mr. Lehrbach was engaged in state highway work with the New York Bureau of Highways.

J. G. HOCKE, formerly president of the General Contracting & Engineering Co., and WM. JOSHUA BARNEY, consulting engineer and formerly second deputy commissioner of docks, New York City, under CALVIN TOMPKINS, has joined with JOHN G. AHLERS, formerly of the Turner Construction Co., to form the Barney-Hocke-Ahlers Construction Corporation, with offices at 110 W. 40th St. The new company will engage in water-front and concrete construction.

WILLIAM ALBERT STINCHCOMB, county surveyor of Cuyahoga County, Michigan, is Democratic nominee for mayor of Cleveland. Mr. Stinchcomb entered the Cleveland city civil engineer's office in 1895, serving in the roads and pavements department. Later he was transferred to the Department of Surveys, working on most of the large surveys made by the city. In 1902 he was made chief engineer of the Park Department by Tom Johnson, who was then Mayor of Cleveland, and served in this capacity until 1909. For the four years preceding his election as county surveyor, he was in private practice and is now serving his second term in that office, although he has been elected for a third term, which begins in September this year. At the last election he led his ticket and next to Newton D. Baker, now Secretary of War, he secured the largest vote ever polled for any office of Cuyahoga County. The Detroit-Superior High Level and the Brooklyn-Brighton bridges have been built under Mr. Stinchcomb's direction.

Engineer Nominated for Mayor of Cleveland

WILLIAM A. STINCHCOMB

H. G. MILLER, formerly with the West Coast Steel Co., Tacoma, Wash., is at present in the service of the U. S. Government in the Hull Department of the Navy Yard, Puget Sound.

F. W. SEIDENSTICKER, formerly in the Chicago office of PURDY & HENDERSON CO., is at present in the Engineering Department of MARSHALL & FOX, architects, Chicago.

R. H. H. SPIDEL, highway bridge engineer with the U. S. Office of Public Roads and Rural Engineering, is at present assigned to field duty at Florence, Ariz. The work at this point is a Federal-Aid project consisting of building an 800-ft. extension to a 700-ft. concrete beam bridge across the Gila River at Florence. The estimated cost is $110,000, which includes approaches and flood protection, and is being done by force account under the direction of the state engineer. Previous to Mr. Spidel's employment in the Office of Public Roads, he was bridge engineer in the Ohio State Highway Department and also bridge engineer for Columbia County, Ohio.

DAVID M. OLTARSH, chief engineer of the Brady-Oltarsh Construction Co., of Johnstown, N. Y., has been commissioned captain of engineers, United States Army, with headquarters at Washington, District of Columbia.

B. F. ENGLAND is at present assistant highway engineer of Jacksonville, Tex. Previously to this employment, Mr. England was highway engineer at Garden Valley, Texas.

HENRY W. HODGE, member of the New York City Public Service Commission, has been called by the Government for military service, and is commissioned a major in the Engineer Officers' Reserve. Major Hodge is to serve as bridge engineer on General Pershing's staff and will leave for France soon.

L. P. WOLFF, consulting engineer, St. Paul, and member of the Minnesota state board of health, has been appointed consulting engineer in charge of water supply and sewerage at the same place. Twenty-two hundred buildings will be required on a space of one thousand acres; estimated cost, four million, and to be built in three months.

MAJOR M. A. BUTLER, engineer reserve officer, chief engineer Twin City Belt Line, St. Paul, has been appointed construction quartermaster in charge of construction of cantonment at Des Moines, Iowa.

ARNOLD T. BROWN, who for the past three years has been assistant engineer for the Anderson-Cottonwood irrigation district, has resigned to engage in private practice.

H. F. SHIPLEY is now principal assistant engineer in charge of the combined division of Highways and Structures in the engineering department of the City of Cincinnati.

MAJOR EARL B. MORDEN, engineer reserve officer, superintendent of construction, Hill Building, St. Paul, has been designated to take charge of cantonment construction at Battle Creek, Mich.

O. H. MANN has been appointed engineer, maintenance-of-way, of the northern division and branches, Chicago, Great Western R.R., with headquarters in St. Paul, vice W. J. CALVIN, resigned.

R. L. KENAN, who for the past three years has been county engineer for Chilton County, Alabama, has recently formed a partnership with FULTON PACE as consulting civil and highway engineers, making a specialty of Federal-aid road projects. Kenan & Pace, under which name the new firm is organized, are at present working on projects for Clay, Cleburne and Toosa Counties, Alabama.

S. B. BENNETT, formerly city engineer of South Vancouver, B. C., has been appointed principal of engineering and allied trades at Winnipeg College. This school is established for the purpose of training returned soldiers.

Y. YAMASHITA, a graduate from the civil engineering department of the Tohoku Imperial University, Japan, is at present in this country, having been sent as an industrial student by the Japanese Department of Agriculture and Commerce, and is making a special study of reinforced concrete under Prof. A. M. Talbot at the University of Illinois, Urbana, Ill.

CLARENCE HEALY has resigned as assistant engineer of the Delaware, Lackawanna & Western Railroad Co. to take the position as vice president of Linde & Griffith Co., contractors, Newark, N. J. Mr. Healy was engaged in the design and construction of buildings and terminals during his railroad experience and will specialize in this work in his new position.

CHARLES EVAN FOWLER, consulting bridge and harbor engineer of Seattle, Wash., is at present and will be for some months located at 3910 Woolworth Building, New York City.

THOMAS MADDOCK has been appointed state engineer of Arizona, vice LAMAR COBB, resigned.

JULIAN MONTGOMERY, recently city sanitary engineer of Austin, Tex., and in charge of general design and construction, has been appointed chief office engineer of the State Highway Department.

ALBERT H. JEWELL, assistant engineer, Kansas State Board of Health, has resigned to become sanitary inspector for the Michigan State Board of Health. Mr. Jewell was with the Kansas board a year, going there from Toledo, Ohio, where he was assistant chemist of the water filtration plant.

FRANK S. KRUG, city engineer of Cincinnati, Ohio, has been again selected by the Rapid Transit Commission as its chief engineer, at a salary of $9000. He will continue to serve as city engineer at $6000 a year. After his first apointment as chief engineer of the commission, a year ago, the local and supreme courts of Ohio declared that the payment of extra compensation nullified the appointment. A legislative act has since been passed which permits him to receive salaries for the two positions.

S. V. TAYLOR, formerly district sales manager of the General Fireproofing Co., and M. J. QUINN, formerly engineer of the Trussed Concrete Steel Co., have recently formed the Concrete Steel Fireproofing Co., with offices at 73 State St., Detroit. The new company is the direct representative of the Concrete Steel Co., of New York City, and the General Fireproofing Co., of Youngstown, Ohio, and will handle a complete line of high-grade fireproof and waterproofing materials.

CHARLES S. CLARK, formerly of the Pennsylvania Steel Co., Boston, has been elected first vice president and general manager of the Laconia Car Co. and will make his headquarters at Laconia, where the business of the company will be transacted.

Army Engineers on Active Duty with Geological Survey

The Director of the Geological Survey authorizes the following statement giving the assignments to duty of the officers of the Engineer Officers' Reserve Corps in connection with military mapping now being done for the War Department:

Maj. R. B. Marshall, as chief geographer in charge of the topographic branch, is instructed to continue general supervision of the topographic surveys now being made for the War Department. His station will be at Washington, District of Columbia.

Maj. Frank Sutton will continue the duties of geographer in charge of the military mapping in the Eastern and Northeastern Departments, reporting to the chief geographer, Maj. R. B. Marshall. His station will be at Washington, District of Columbia.

Maj. W. H. Herron will continue the duties of geographer in charge of the military mapping in the Southeastern Department, reporting to the chief geographer, Maj. R. B. Marshall. His station will be at Washington, District of Columbia.

Maj. Glenn S. Smith will continue the duties of topographic engineer in charge of the Division of Military Surveys in connection with the military mapping, reporting to the chief geographer, Maj. R. B. Marshall. His station will be at Washington, District of Columbia.

Capt. Claude H. Birdseye will continue the duties of topographic engineer in charge of the military mapping in Texas, reporting to the chief geographer, Maj. R. B. Marshall. His station will be at Washington, District of Columbia

Majs. Robert Muldrow (topographic engineer), Joseph H. Wheat (topographic engineer), William H. Griffin (topographic engineer) and Robert H. Chapman (topographic engineer), Capts. E. I. Ireland (topographic engineer) and Asahel B. Searle (topographic engineer), First Lieuts. T. Foster Slaughter (assistant topographer), W. H. S. Morey (topographer), Samuel P. Floore (assistant topographer) and Reuben A. Kiger (assistant topographer), and Second Lieuts. Leo B. Roberts (assistant topographer) and Edwin C. Burt (junior topographer) will continue their work in connection with the military mapping in the Eastern and Northeastern Departments, reporting to Maj. Frank Sutton.

Maj. James H. Jennings (geographer), Capts. Albert Pike (topographic engineer), Carl L. Sadler (topographic engineer), William L. Miller (topographic engineer) and Eugene L. McNair (topographic engineer), First Lieuts. Thomas H. Moncure (assistant topographer), Luria L. Lee (assistant topographer) and Elmer L. Hain (assistant topographer), and Second Lieuts. Oliver G. Taylor (assistant topographer), Wilmer S. Gehres (junior topographer), R. M. Herrington (junior topographer), James M. Rawls (assistant topographer) and Martin A. Roudabush (junior topographer) will continue their work in connection with the military mapping in the Southeastern Department, reporting to Maj. W. H. Herron.

Capt. Herbert H. Hodgeson (topographic engineer) and First Lieuts. Oscar H. Nelson (assistant topographer) and Stuart T. Penick (assistant topographer) will continue their work in connection with the military mapping in the Southern Department, reporting to Capt. Claude H. Birdseye.

Maj. George T. Hawkins (topographic engineer), Capts. William O. Tufts (topographic engineer), John G. Staack (topographic engineer) and Calvin E. Giffin (topographic engineer) and Second Lieut. Frank A. Danforth (assistant topographer) will continue their work in connection with the military mapping in the Southern Department, reporting to Thomas G. Gerdine, geographer, United States Geological Survey.

Maj. Albert M. Walker (topographic engineer) is assigned to special duty at Washington, D. C., in connection with the assembling of data for use in field mapping in the State of Washington, where he will proceed about July 1 for the purpose of taking up the field work under Thomas G. Gerdine, geographer, United States Geological Survey.

Capts. Clyde B. Kendall (topographic engineer) and Bertram A. Jenkins (topographic engineer), First Lieut. John R. Eakin (topographer), and Second Lieut. John H. Wilson (assistant topographer) are assigned to special duty at Washington, D. C., preliminary to their transfer to France for duty with troops, reporting to Maj. R. B. Marshall, Washington, District of Columbia.

Capt. James W. Bagley (topographic engineer), although on active duty, is at present unassigned.

First Lieut. L. S. Leopold (assistant topographer) has been assigned to inspection work of the office, drafting and proofreading of maps in connection with the military mapping, reporting to the chief geographer, Maj. R. B. Marshall.